QUI TRANSTULIT SUSTINET

FIFTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Connecticut Board of Agriculture.

1871-72.

Printed by order of the Legislature.

HARTFORD:
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1872.

STATE BOARD OF AGRICULTURE.

1871-2.

His Excellency MARSHALL JEWELL, *Ex-officio*.

APPOINTED BY THE GOVERNOR AND SENATE.

	Term Expires.
E. H. HYDE, Stafford,	1872.
ALBERT DAY, Brooklyn,	1873.
H. L. STEWART, Middle Haddam,	1872.
J. T. ROCKWELL, Winsted,	1873.

ELECTED BY THE AGRICULTURAL SOCIETIES.

Hartford County,	S. M. WELLS, Wethersfield,	1872.
New Haven "	W. H. POND, Milford,	1873.
New London "	JOHN BREWSTER, Ledyard,	1873.
Fairfield "	THOMAS A. MEAD, Greenwich,	1872.
Windham "	GEORGE SANGER, Canterbury,	1872.
Litchfield "	NATHAN HART, West Cornwall,	1872.
Middlesex "	Dr. NOAH CRESSY, Middletown,	1873.
Tolland "	W. H. YEOMANS, Columbia,	1873

ELECTED BY THE BOARD.

T. S. GOLD, West Cornwall, Secretary.

OFFICIAL LIST.

Gov. Marshall Jewell, Pres.
E. H. Hyde, Stafford, Vice Pres.
T. S. Gold, West Cornwall, Sec.
J. S. Allen, East Windsor, Treas.
Dr. Noah Cressy, Middletown, Vet. Surg.
Prof. S. I. Smith, New Haven, Entomologist.
Prof. W. H. Brewer, " Botanist.
Prof. S. W. Johnson, " Chemist.
E. H. Hyde, Dr. N. Cressy, T. S. Gold, } *Commissioners on Diseases of Domestic Animals.*

An Act for the Incorporation of a State Board of Agriculture.

General Assembly, May Session, A. D. 1871.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

SEC. 1. The governor, one person appointed from each county by the incorporated agricultural society in that county or when there are several incorporated societies in one county, by mutual agreement of those societies, or in rotation from each society as it may be arranged by them, and four persons appointed by the governor, with the advice and consent of the Senate, shall constitute the State Board of Agriculture.

SEC. 2. One half of the appointed members of the board shall retire from office on the second Wednesday of May, in each year, according to their appointments. The vacancies thus occurring shall be filled by the Governor and Senate, or by the agricultural societies, as the offices were before filled, and the persons thus appointed shall hold their offices for two years from the expiration of the former terms. Other vacancies may be filled in the same manner for the remainder of vacant terms. At the first meeting of the board, the individuals whose term of office expires in one year shall be determined by lot.

SEC. 3. The board shall meet at one of the state capitals, where the general assembly shall meet at least once in each year, and as much oftener as may be deemed expedient. The members of the board of agriculture shall receive no compensation for their services but each member shall receive his necessary traveling expenses while engaged in the duties of his office, for a term of service not to exceed fifteen days in each year unless delegated by the board to some special duty requiring longer service.

SEC. 4. The board may appoint and prescribe the duties of a secretary who shall be ex-officio a member of the same; and who shall receive for his services out of the appropriation for the use of the board, such sum as the board shall direct.

Sec. 5. The board shall investigate such subjects relating to improvement in agriculture and horticulture in this state as they think proper, and may take, hold in trust, and exercise control over donations or bequests made to them for promoting agricultural education, or the general interests of husbandry.

Sec. 6. The board may prescribe forms for, and regulate the returns required of the different agricultural societies, and furnish to the secretary of each such blanks as they deem necessary to secure uniform and reliable statistics, and any society neglecting in any year to comply with the regulations of the board, shall not be entitled to the allowance from the state, as by law now provided, the year next succeeding.

Sec. 7. The board shall annually on, or before the fourth Wednesday of May, by their chairman or secretary, submit to the Legislature a detailed report of their doings, with such recommendations and suggestions as the interests of agriculture may require.

Sec. 8. The secretary of the board, under the direction of the comptroller, shall in each year cause to be made and printed as full an abstract of the returns of agricultural societies as he deems useful, together with the report to the Legislature; provided that the whole volume shall not exceed three hundred and fifty pages octavo, and the whole number to be printed shall not exceed four thousand, one thousand for the use of the General Assembly, and three thousand for distribution under direction of the board.

Sec. 9. The secretary shall visit different sections of the state for the purpose of inquiring into the methods and wants of practical husbandry; ascertaining the adaptation of agricultural products to soil, climate, and markets; encouraging the establishment of farmers clubs, agricultural libraries and reading rooms, and of disseminating useful information in agriculture by means of lectures, or otherwise, and shall annually make a detailed report to the board.

Sec. 10. The secretary or members delegated by the board shall as far as practicable, visit the different agricultural exhibitions in the state and report to the board upon matters pertaining to the interests of agriculture as indicated by these exhibitions.

Sec. 11. For the purpose of preventing the spread of contagious diseases among neat cattle and other domestic animals, authority is conferred upon the board of agriculture as follows: Whenever in the judgment of the board public safety demands, said board shall have the power to prohibit the bringing, transportation, or introduction of any cattle or other domestic animals into this state from any place whatever,

by any railroad or any incorporated company, or by any person. And every such company or person who shall bring, transport, or introduce any cattle or other domestic animals into this state after said board shall have issued an order to such company or person, forbidding the same, or after the board shall have published for five successive days an order in such newspapers published in this state as the board may direct, forbidding any person or company to do so, shall pay a fine not exceeding three hundred dollars for each and every offense, and every officer or agent of any company or other persons who shall violate such order shall be subject to the fine aforesaid. In case of the introduction into this state of a number of cattle or other domestic animals contrary to the orders of said board as aforesaid, the introduction of each animal shall be deemed a separate and distinct offense.

SEC. 12. Whenever any contagious disease breaks out or is known to exist in any section of this state, the board shall have the power at their discretion to quarantine all infected animals, or those supposed to have been exposed to contagion, and to prohibit the driving or transporting of such animals or any others upon the public highways in any town or district where such movement of animals is considered by the board as dangerous to the public safety.

SEC. 13. The board are authorized to enter upon any premises where there are any animals that are supposed to be affected with any disease, to investigate the facts and to make all necessary regulations for the prevention, treatment, care, and extirpation of such disease, and whenever any person shall fail to comply with any regulation so established by the said board, they shall be punished by a fine not exceeding three hundred dollars, or by imprisonment not exceeding one year.

SEC. 14. The board may appoint suitable persons on or near the several highways, railroads, and thoroughfares in the state, whose duty it shall be strictly to inquire into all violations of this act, and to report the same to the board for immediate prosecution.

SEC. 15. The board of agriculture may appoint three commissioners on diseases of domestic animals and delegate to them the full powers which by this act are conferred upon the board.

SEC. 16. All prosecutions for the violation of any of the provisions of this act shall be commenced within thirty days from the commission thereof.

SEC. 17. The sum of two thousand five hundred dollars is annually appropriated for the use of the board, and the comptroller shall

on the first day of January in each year, draw his order upon the treasurer of this state for this sum in favor of the board. The board shall appoint a treasurer who shall receive and safely keep all money appropriated for and belonging to the board, and he shall pay it out only on bills approved by the board. The treasurer shall make a full report to the board to be included in the report of the secretary to the General Assembly.

SEC. 18. The first meeting of the board for organization shall be held in Hartford on the first Wednesday of August, 1871. Subsequent meetings may be called by the president or secretary upon the request of four members of the board.

SEC. 19. All acts or parts of acts inconsistent herewith are hereby repealed.

SEC. 20. This act shall take effect from and after its passage. Approved July 27th, 1871.

REPORT.

To the General Assembly of the State of Connecticut:

The Connecticut State Board of Agriculture met in Hartford the first Wednesday in August, 1871, as provided in the act of incorporation.

For temporary organization, on motion of Hon. E. H. Hyde, His Excellency Marshall Jewell was chosen President, and Nathan Hart, Secretary. After some desultory conversation pertaining to the general interests of the Board, Governor Marshall Jewell was chosen President.

On motion of E. H. Hyde, it was

Voted, That when the Board adjourns it be to August 16th at 12 M., at the governor's room in Hartford.

A resolution was passed instructing the secretary to notify the agricultural societies in the several counties of the action of the meeting, that members might be appointed according to the provisions of the act.

The Board then adjourned to the time and place before voted.

NATHAN HART, SECRETARY *pro tem.*

The Board met, according to adjournment, August 16th, at 12 M., His Excellency Marshall Jewell, President, in the chair.

On motion of Mr. Hyde, Mr. Plumb, of Fairfield County, was invited to participate in the doings of the meeting except voting.

Voted, That the Board appoint a vice-president, and Hon. E. H. Hyde was chosen.

Voted, That the Board proceed to elect a secretary, pending which, on motion of N. Hart, Messrs. Hyde, Plumb, and Cressy, were appointed by the Chair to bring forward business for the afternoon session. The Board adjourned to 2 P. M.

NATHAN HART, SECRETARY *pro tem.*

The Board met at 2 P. M. An informal ballot was taken for secretary, resulting in the unanimous choice of T. S. Gold, of West Cornwall, who was declared elected, and entered on the duties of his office.

The official list was completed by the choice of J. S. Allen, of East Windsor, Treasurer; Dr. Noah Cressy, Middletown, Veterinary Surgeon; Professor S. I. Smith, New Haven, Entomologist; Professor W. H. Brewer, New Haven, Botanist; Professor S. W. Johnson, New Haven, Chemist.

A drawing took place according to section 2d of the act to determine the term of office of the members. Hartford County, one year; New Haven County, two years; New London County, two years; Fairfield County, one year; Windham County, one year; Litchfield County, one year; Middlesex County, two years; Tolland County, two years.

MEMBERS APPOINTED BY THE GOVERNOR.

E. H. Hyde, one year; Albert Day, two years; John T. Rockwell, two years; H. L. Stewart, one year.

Delegates were then chosen to attend the various agricultural Fairs in the state, as follows:

HARTFORD COUNTY (no fair)—E. H. Hyde.
Pequabuck, Bristol, October 4.

NEW HAVEN COUNTY (no fair)—H. L. Stewart.
Milford and Orange—Orange, September 28.
Oxford, September 28.
Union Agricultural Society, Wallingford, October 10, 11.

NEW LONDON COUNTY—S. M. Wells.
Norwich, September 26, 27, 28.

FAIRFIELD COUNTY—W. H. Yeomans and J. Brewster.
Norwalk, September 19, 20, 21, 22.
Danbury, October 3, 4, 5, 6, 7.
Ridgefield, September 26, 27, 28, 29.

WINDHAM COUNTY—N. Hart, T. A. Mead.
Brooklyn, September 16, 17, 18.
Woodstock, September 19, 20.

LITCHFIELD COUNTY—Messrs. Hyde and Day.
Litchfield, October 4, 5.
Watertown, September 6, 7.
Union, Falls Village, September 12, 13.
Housatonic, New Milford, September 26, 27.
Valley Park, Wolcottville, October 11, 12.
Woodbury,

MIDDLESEX COUNTY—W. H. Pond.
Middletown, September 26, 27, 28, 29.

TOLLAND COUNTY—George Sanger, W. H. Yeomans.
Rockville, September 27, 28.
TOLLAND COUNTY EAST—Stafford Springs, October 12.

A resolution was passed for the appointment of three commissioners on diseases of domestic animals. They were appointed as follows: Hon. E. H. Hyde, T. S. Gold, and Dr. N. Cressy.

The secretary presented letters from the California Agricultural Society and the Michigan Pomological Society, seeking an exchange of fruits for exhibition. The secretary was directed to furnish such exchanges as he could procure.

A committee of three was appointed, consisting of Messrs. Day, Stewart, and Gold, to arrange for the time, place, and subject for discussion at the winter meeting, with authority to secure lecturers for the occasion. The secretary was requested to solicit proposals from the different agricultural societies for accommodations for the winter meeting.

A communication was presented by the secretary from the signal-service officer of the War Department upon the subject of weather reports. The secretary was directed to make further inquiries of the department.

The secretary was directed to prepare blanks for the returns from agricultural societies.

Messrs. Stewart, Brewster, and Yeomans, were appointed Auditors.

Resolved, That the treasurer be required to give bonds in the sum of three thousand dollars for the faithful performance of his trust.

The Board adjourned *sine die*.

T. S. GOLD, *Secretary*.

The Connecticut Board of Agriculture met at the Attawaugan House, in Danielsonville, January 9th, 1872, at 1 P. M., Hon. E. H. Hyde, Vice-President, in the chair. Present, Messrs. Mead, Stewart, Yeomans, Hyde, Day, Sanger, Hart, and Gold. At later meetings Messrs. Rockwell, Pond, and Brewster, were in attendance.

The secretary reported the arrangements for the meetings as announced in the programme, which were approved.

An adjourned meeting was held Wednesday, at 9 P. M.

The secretary presented a communication from the chief signal-officer of the War Department, requesting the appointment of a permanent committee by the Board, to confer, from time to time, with the chief signal-officer of the army, and to take, in conjunction with him, such steps as may be deemed desirable, that agriculture as well as commerce might participate in the benefits to be derived from the observations of that department. Professor Brewer and Messrs. Gold and Yeomans were appointed.

A committee, consisting of Messrs. Hyde, Gold, and Pond, were appointed to make preliminary arrangements for an ex-

change of fruits with all the states, for the purpose of holding a pomological exhibition in the autumn of 1872, and report to the Board at the annual meeting. At a subsequent meeting Mr. Hyde was excused from serving on the committee, and Mr. Stewart was appointed.

Adjourned to 8 A. M. Thursday, January 11th.

The Board met Thursday, at 8 A. M.

Resolved, That the annual meeting be held on the last Wednesday in May.

The secretary presented a communication from the commissioner of agriculture, asking for the appointment of a committee of two to meet at Washington with delegates from agricultural colleges and societies, to confer upon the general interests of agriculture.

Governor Marshall Jewell and Mr. J. S. Allen were appointed as the committee, with power to elect substitutes.

Adjourned to 9 P. M.

The Board met Thursday, January 11th, at 9 P. M. The following resolution was passed:

Resolved, That the salary of the secretary be seven hundred dollars per annum, with necessary traveling and other expenses.

The Board adjourned to Friday, at 8 A. M.

At this meeting on Friday the following resolutions were passed:

Resolved, That the Board appropriate four hundred dollars to Professor Johnson, to be used for chemical investigations.

Resolved, That the Board appropriate two hundred dollars to Professor S. I. Smith, Entomologist, for investigations of insects.

Resolved, That a committee be appointed to confer with the state house building committee, to secure proper accommoda tions for the Board.

Governor Marshall Jewell and Messrs. Allen and Gold were appointed as this committee.

The Board then adjourned.

WINTER MEETINGS.

The public winter meetings of the State Board of Agriculture of Connecticut were held in Danielsonville, on the 9th, 10th, 11th, and 12th of January, in the spacious and comfortable hall of the new school-house at that place, and the attendance at most of the meetings was gratifying and encouraging.

The sessions commenced on Tuesday, January 9th, at 2½ o'clock, Vice-President, Hon. E. H. Hyde, in the chair.

The president, on calling the meeting to order, said: "We are very glad to be permitted to come together in this section of the state. Although a little out of the centre, perhaps, in an agricultural point of view, we are certainly in the midst of one of the most prosperous manufacturing sections of our state."

Mr. George Sanger, of Canterbury.—*Mr. President and Gentlemen of the Board:* I desire, as a representative of the Windham County Agricultural Society, and also in behalf of the Woodstock Agricultural Society, to extend to the members of the Board a most hearty and earnest welcome to our county. We are glad to have you with us, gentlemen, and we most cordially welcome among us those gentlemen of science who are here to speak to us upon the various subjects which may be brought to our attention.

It has been truly said in my hearing this morning, that the farmers of Connecticut are not acquainted with each other as they ought to be, and I sincerely hope that these meetings during this week may do much in the direction of bringing the farmers of the different sections of the state together in friendly personal intercourse. It will afford us the highest pleasure if we shall be able to contribute, in any measure, to your comfort and happiness while you are with us, and to the success of the meetings of the Board during this week. Again, gentlemen, we bid you a hearty welcome.

Mr. Gold. It was because we had confidence in the assurances of the gentlemen of Windham County that they desired to meet us that we came here. They came to us with the declaration that they would be glad to see us, that they would

be glad to become acquainted with the farmers in other sections of the state; and these assurances were as kindly received as they were heartily given. We have met a cordial reception so far, and we hope that when you are through with us you will not be sorry that you have given us this invitation.

The president stated that the first subject upon the programme for discussion was POTATOES, and called upon the secretary to open the debate.

MR. GOLD.—In discussing the subject of potatoes at this time, it would be desirable to speak of the varieties which we have cultivated—the varieties that we favor as well as those that we have discarded; also our modes of culture—those which have proved successful as well as those which we have discarded, or which have been seen to be unsuccessful with others; the manures adapted to this crop; the yield which we have obtained, and which is common to the different sections of the state with which we are acquainted; the yield of different varieties upon different soils, and treated in the different methods which we may explain; the best modes of storing or preserving potatoes during the winter, for our own use or for market, and the uses for which they are employed, either for the table, for market, or for feeding animals; also the markets where we may sell our potatoes, the extent of those markets, and the prices obtained for the crop.

All these topics seem to come properly before the Board for discussion at this time. Without proceeding to give my own practice upon any of these points, or to make any suggestions, I would leave the matter in the hands of the Board, and the gentlemen assembled here. All present are invited to unite with the Board in the discussion of these subjects, the object being to gather as much information as possible from all sources that will be useful to the farmers of the state, but especially from the farmers themselves.

DR. BALDWIN, of Canterbury.—A few days ago, in view of this meeting, I wrote out my views upon the subject of raising corn and potatoes as adapted to my situation. That is a low stand-point, I confess, but a stand-point that many of the farmers of Windham County occupy.

Doct. Elijah Baldwin, of Canterbury, presented a dissertation, wherein he gave an account of his mode of raising corn and potatoes. By lining both ways he is able to cultivate them with but little manual labor. The gist of his discourse was how to raise the most corn and potatoes with the least labor. He also gave a recipe to manufacture home-made super-phosphate of lime, which he has found available.

Recipe for home-made super-phosphate of lime. Articles required: Cracked bone, sulphuric acid, a large kettle, a small kettle, plaster of Paris, soil free from gravel, &c., &c. Put four pails of water in a large kettle, add forty pounds of oil of vitriol, (sulphuric acid,) add one hundred pounds cracked bone; after this has stood twenty-four hours, put under the kettle a moderate fire, and continue to simmer till the larger pieces of bone will give a little under the finger. During all this time the contents of the kettle should be stirred occasionally. Make a bed somewhat like a mortar bed, (smaller,) spread over it as much dirt as you choose to use—one barrel or more—then upon this one hundred pounds of plaster of Paris; then add the mixture from the kettle—and for a superior article, spread upon this twenty-five pounds of Peruvian guano. For buckwheat the guano is essential. Mix all carefully with the hoe. It is now a very sticky mass. Let it lie till next day and it will become friable and can be easily handled. It should not be allowed to lie in large heaps and heat. The solution of bone can be prepared beforehand and put in flour barrels or any convenient barrels, and if they leak set them on dirt—there will be no loss. To pour the acid, turn the carboy over a sleeper so as to raise it above the small kettle. This can be done by one or two men behind it. A holder of paper or rags will prevent danger from spatterings on the bail. Empty without haste into the large kettle. After weighing a few times the measure will determine with sufficient accuracy.

Question. What varieties of potatoes do you raise?

Dr. Baldwin. I have raised the Davis Seedling, because it is a great yielder, and always finds a ready market.

Question. How much is your yield to the acre?

Dr. Baldwin. I have no big crops to brag of. I planted about five acres this year. I have about a hundred bushels in my cellar, and gathered about three hundred bushels for market. The potatoes sold for sixty-five cents a bushel, which, deducting the expenses, left me forty-eight cents clear for the potatoes, delivered at the station. The best potato for my use is the Dover, but it is a small yielder. We have a new potato with us, that has not been disseminated at all, which has yielded this year better than any potato that I ever raised. It originated in my neighborhood. It resembles very much the Jersey Peach Blow. I should say that potato yielded this year at the rate of 200 bushels to the acre, where other varieties yielded perhaps 150 bushels. It was hoed but once, but cultivated and plowed several times. It has no name but the Tarbox. The Early Rose, in the same ground, I hardly think yielded fifty bushels to the acre. The Monitor yielded full as much as either of the others, but rotted to a considerable extent; not so badly, however, I think, but that it left 100 bushels to the acre. That variety is not so saleable, and I do not think it so desirable as the others, although last year it was mealy and good.

Question. What is the character of the land?

Dr. Baldwin. An old pine plain, that yielded a great many more potatoes, at forty-eight cents a bushel, than would pay for it in any market where it can be put up at auction.

Mr. Hutchins, of Danielsonville. What I have to say has no immediate connection with either corn or potatoes, but is intimately connected with both. The Vicar of Wakefield tells us that his wife had a great notion of applying for letters patent, and was exceedingly enthusiastic in her plan. He inquired of her what it was that was so important that she would like to get a patent for it. "Why," said she, with the utmost vivacity, "I have learned that our daughter's hands are never so soft as when they do not do any thing at all." Now, what I have to say is little more likely to obtain a patent than the discovery of the Vicar of Wakefield's wife, and yet it is something which every farmer should have fully impressed upon his mind; and that is, that to the presence of *weeds* in

our fields is to be attributed, in great part, the entire absence of profit in the cultivation of many of our crops. Now, if I can convince every one here present of the mischievous character of weeds, of every kind, so that they will carry the plan I shall suggest into effect hereafter, they will not only be willing to pay me handsomly for my information, but consider it more valuable than all the benefits they ever have or ever will reap from agricultural societies or agricultural books.

Now, Mr. President, if you disbelieve what I am about to say, just visit your neighbors' corn fields and potato fields about the last of next August, just after they get through with their haying, when every thing is pressing, and it is a question in my mind whether you will not find weeds there sufficient to destroy, in the long run, the net profits of all the farming operations of the year. Let me say right here, for I know it from experience, that you may bury the seeds of those weeds and let the field lie uncultivated for ten or fifteen years, and when you do cultivate it again, it will present a crop of weeds more readily than anything you can place upon the soil; whereas, if you cultivate that ground thoroughly, and exterminate every weed from it, you will not have them then or thereafter to mix with your hay or any other crop that may follow. I have tried it. I had a large livery stable, and kept upon the average about twenty horses, some ten or a dozen years. I made one pledge when it came into my possession, that no part of that manure should ever be appropriated to the raising of weeds, and I can say that I have planted eight or ten acres where I could carry under one arm every weed that grew upon that land. I have been in the habit, also, of letting tenements, and I have found my tenants exceedingly anxious to get large gardens; they will put an immense quantity of manure upon them, and plant them with the nicest exactitude, but if you go around by the side of those gardens in August, you cannot tell what crop is upon any part of them, by reason of the flourishing condition of the weeds.

Dr. Baldwin. I consider that the seeds of weeds in the soil, provided it is well worked, are high sources of fertility. Not that they should be allowed to grow, but if a soil is quick

with them, and kept well worked, they are a grand source of fertility.

Mr. C. W. Low, of Danielsonville. I have cultivated large tracts of land in New Jersey, in Iowa, and some in this state, and I should be very glad to pay something for a large quantity of weed seed in the soil. I don't want to have the weeds grow with the crop, but I should be willing to have them get up three or four inches. I have always found that the most profitable land to cultivate which had the most weed seed in it, and had the most germinate and come up.

Mr. H. L. Reade, of Jewett City. Dr. Baldwin brought in several times, in the course of his admirable address, something about ashes. It is almost impossible to get any amount of ashes in this vicinity. How does he succeed in finding them?

Dr. Baldwin. That is one of the benefits of coming up here and learning. We shall buy what ashes can be had, and there is where we shall get the advantage of our neighbors who do not attend the meetings. Mr. Reade can get all he wants in Norwich.

Mr. Reade. One word about the value of ashes upon corn. Twenty-one years ago, my father carted from Greeneville up to my farm in the neighborhood of Jewett City, perhaps two hundred bushels of ashes. That field has been planted half a dozen times since, and last summer we sowed it with corn for the cattle, and on the ground where that pile of ashes lay, covering perhaps two hundred square feet, some stalks grew at least eight feet high, from which I gathered two sizeable ears. Ten feet from there, the stalks were about four feet high. That is what ashes do on the sandy loam on the Quinnebaug river. If we can buy them, as the doctor suggests, for twenty-five, or even thirty-five cents a bushel, it is better than to buy guano or phosphates at sixty dollars a ton.

One word with reference to tying corn with birch. It seems to me that rye straw, if you have it, is better than birch. It would take a great deal of time to go into the woods and cut the birches.

The doctor's estimate of the Early Rose is different from

mine. It may be that on his soil it does not do well, but on our soil it is the best variety that we use. On a piece of not more than half an acre, the man who managed my farm raised about 120 bushels. It seems to me that, for our sandy river bottoms, there is nothing like the Early Rose.

MR. LOW.—I should not wish to say a word in favor of the Early Rose if the gentleman would go with me to the other side of the river, where I would show him some specimens of the Early Rose that were raised in a different way from his; where the manure was applied in large quantities, and the yield was 300 bushels to the acre. I will show him some of that description in the cellar of Mr. Lillibridge. I have found that the Early Rose required high feeding. I have also found that one acre of potatoes manured well, the manure plowed in, with ashes and plaster, or phosphate, in the hill, will produce about as large a crop as three acres, planted as the doctor suggests. I believe it is more profitable to use less land and less labor, and get larger crops. I have found that twenty or thirty loads of manure to the acre secure a much better proportionate result than ten loads.

MR. A. G. LYMAN, of Columbia.—I came to this meeting particularly to hear the discussion with regard to this matter. I suppose that if there is any object in holding meetings of this kind, it is to get at facts. Mere theories are not what we want. Theory is good, but practice is better.

Last year, for my own gratification, not expecting that it would ever come to the notice of anybody, I made a series of experiments upon potatoes, with different kinds of manures on the same soil. It was only a small piece of ground of fifteen rods that I tried the experiments upon. I tried five different kinds of manure upon that same piece, to see if there was any difference. The soil was apparently the same, as far as I could see—rather light, with a gravelly bottom. It was not a piece of ground that everybody would naturally take to produce a great crop—not one especially adapted to experiments—but it was all I had, and therefore I used it.

The Garnet Chili was the variety I planted. And here let me observe, before I give the result, that I believe you can

raise double the quantity of the Garnet Chili on the same manure that you can of the Early Rose. Although the Early Rose, in my estimation, is far the best potato, it is not so considered in the market. Our foreign population do not like the Rose; it is not strong enough for them. I did not lay out my piece of ground exactly according to prescribed rules, because I simply took a chain and drew it along the ground, and planted my potatoes right on this chain. I did not make a furrow a foot deep, and I never should, because my experience proves that potatoes want air and light. All you need is dirt enough over them to keep the sun from burning them. I do not believe that potatoes grow as well deep down in the furrow. I did not put a spoonful of manure on the piece. Last year there was a load of coarse hog manure, made from leaves and other bedding, put on the ground, and it was planted to white beans; but that pest of the farmer every where, the woodchuck, relieved me pretty much from the trouble of harvesting the crop. I plowed late, and planted the 14th of June. That is late planting, gentlemen, for potatoes. It wont do to try it always. I think May is far preferable, or April, if you can get them in and get them up. But they were the last I planted, and I got them in on the 14th of June. The hills were about two and one-half feet apart, and the rows three and one-half feet. In the first four rows I put a double handful of unleached ashes in the hill—nothing else. In the next two rows I put a good large handful of hen manure in each hill—nothing more—keeping the potatoes a little away from it.

Mr. Low.—Did you put the dry ashes in immediate contact with the potatoes?

Mr. Lyman.—I did, sir. I should not be at all afraid to plant potatoes right in ashes. I dropped the potatoes, and then dropped the ashes right on the potatoes in the hills. The ashes were not wet but dry. The hen manure was strong and good; it was not all dried up, so that there was no richness to it. Then, having a compost heap of lime, salt, and muck, I mixed ashes with it, and put a good double handful into the hills in the next two rows. On the next four rows I used su-

perphosphate—Bradley's XL. In the remaining two I put ashes in the hills, as in the first four rows.

When the potatoes came up I could not see any apparent difference in them. There came a little rain soon after they were planted, and they came up, and seemed to flourish finely. I hoed them twice. They were kept quite free from weeds, because the dry weather seemed to prevent their growing very fast. When I came to harvest the potatoes I did not weigh them, as I should, perhaps, if I had known that I was making an exact experiment to be reported, but I measured them as carefully as I could, and noted the difference between them. I should have said that the seed was from quite large-sized potatoes, cut into pieces with two eyes, and two pieces put into a hill.

The first two rows yielded two bushels and one peck of very nice potatoes. That was where the ashes were put. The rows were about five rods long, and the piece about three rods wide. The next two rows yielded two and one-half bushels. That made, say four and three-fourths bushels from the four rows, or a little over a bushel to a row. The next two rows (where I put the hen manure) only gave me about a bushel and a half; whereas, on the two right before them, with no perceptible difference in the hills, I had two and a half bushels. The next two rows (where I used the compost) yielded a bushel and three-quarters—a little more than where the hen manure was.

Mr. Low.—About what proportion of salt in the mixture?

Mr. Lyman.—About half a bushel of salt was put in when the lime was slacked.

Mr. Low.—One-third of the mixture?

Mr. Lyman.—No, sir, not over a tenth or a fifteenth. I did not make the mixture for the potatoes, but for other purposes. I should never use it for such a purpose, because potatoes do not need lime. I used it because I happened to have it, to see what the effect would be.

From the four rows where I used the phosphate I got just two bushels from each of the two rows, as near as I could de-ermine without weighing, making four bushels—three pecks

less than the yield of the first four rows where the ashes were used.

There is another point to be considered in this, and that is as regards the marketable potatoes and the small ones. We all know that sometimes we can raise a greater quantity by weight, even if they are small, than if they are large, and of suitable size for market; therefore, that is a point to be considered. On the first two of the four rows, where I used ashes, I had only a peck of small potatoes, leaving me two bushels and a half of good sized potatoes fit for market. Where I had the hen manure I had half a bushel of small potatoes, or double the quantity that I had where I put ashes in the hill. Where I used the salt and lime I had over three pecks of potatoes that were not what I call sizable for market. When I got to the phosphates I had only one peck again; and when I got back to the ashes I had only half a peck.

These simple experiments, which I tried for my own satisfaction merely, bring two things prominently to view in respect to this piece of ground. The first is, that however profitable hen manure may be for some things, it is not profitable for potatoes; and the second is, that ashes and phosphates are the two best articles, ashes being the best of all.

I consider, as the gentleman on my right said, that the Early Rose can not be overfed. I think that variety needs a strong soil and high nourishment. Some of my neighbors, who last year planted the Davis Seedling, the Garnet Chili, and the Early Rose, side by side, raised double the crop of the Davis and the Chili that they did of the Rose, with the same culture. The practical result would seem to be, that if we are going to sell our potatoes to the foreign population, who like a stronger potato than the Early Rose, and if we have a soil that with less manuring and less culture will produce as much or more of some other variety than the Rose, we should plant that other variety.

Mr. Low. I have experimented with ashes a great many times, on different soils, and I find they are the very best fertilizer for potatoes; but I find that potatoes do not

come up well with strong dry ashes. Are you quite sure that your ashes were good, strong ashes?

MR. LYMAN. Oh yes, they were ashes from hickory, and other hard wood.

MR. LOW. I have lost a crop, and my brother lost one this year, by putting dry ashes upon the potatoes.

MR. LYMAN. Three years ago, I planted some in my garden. Immediately after, there came a very heavy rain, and they did not come up. Whether the rain had anything to do with it or not, I can't say. Perhaps it produced such a strong lye from the ashes that the tubers were killed. I think very likely that was the trouble.

MR. LOW. I have found that leached ashes in the hill would answer the purpose for potatoes quite as well as dry; but I do not consider it safe to put dry ashes on potatoes. I was quite satisfied with my experiment, and never tried it again. It may be that rain following immediately after the planting would make a great difference.

MR. GOLD. A gentleman of my acquaintance got a bushel of the Early Rose last spring, cut them and rolled them in ashes a week or two before planting; then he planted them, and that was the last he saw of his potatoes.

QUESTION. There is a question in my mind in regard to fertilizing with seed. We all know that when the Early Rose first came around, when they were sold for a dollar a pound, every person who happened to have one of those potatoes cut it into the very smallest pieces possible. I have known it carried to the extent of splitting an eye, leaving a piece of the tuber not much larger than a pea; and yet they obtained a number of large sized potatoes. Now, if the size of the seed has anything to do with the crop, why should it not be affected by such an operation? The result of my experience is, that if you want to obtain the largest number of potatoes from a small amount of seed, if you plant but one eye in a piece, the result will be much more surprising than if you planted a larger piece. How is it? If you cut a large potato into two or three pieces, you will do well if you get a peck from it; but I have divided a potato into single eyes, and

have obtained two bushels from it. There is something about this matter that needs explanation. I should like to have some one who has had more experience than I have in the matter explain how that is.

Mr. Low. I think I can explain that. Yesterday, I bought potatoes for one cent a pound. We pay three cents a pound for phosphates. I always plant large potatoes, marketable potatoes, and would not plant any other, unless they were very high, because I think that is the cheapest way to start the germ, the life principle, of the potato. If they are only thirty, forty, or fifty cents a bushel, I plant a whole potato; if they are seventy-five cents a bushel, I cut a good-sized potato in two, and put one half in a hill. When potatoes are a cent a pound and phosphates cost three cents a pound, I think it is more economical to start the little germ with the potato, for it gives up its life to its successor, than to buy phosphates.

Question. Is it not a fact, that if you plant a whole potato, you have a great many more potatoes in the hill than if you plant one or two eyes, and, being crowded, they are naturally smaller? My experience leads me to think that is so.

Mr. Low. If you plant whole potatoes, you will have very few more sprouts than if you plant pieces. If you plant a whole potato, there will not be more than five sprouts, and they will be strong and vigorous; whereas, if you cut it up, the sprouts will be small and spindling. I have planted fifteen bushels to the acre.

Mr. Stewart, of Middle Haddam. The best success that I have ever had in raising potatoes, in respect both to yield and size, has been where I have planted no potatoes at all, but took the sprouts and cut them up, as you would a verbena or a grape vine, or anything that is propagated in that way. Two years ago I tried the experiment of setting out sprouts, and I also planted large potatoes and small. They were the Early Rose, those raised from cuttings, and were fit to eat some ten days earlier than the others, and produced the heaviest crop. If a man is going to plant ten or fifteen acres, it would be a great deal of trouble. I know of one man who planted six acres from four Early Rose potatoes, by cutting

the shoots in that way. He reported his yield to the acre between three and four hundred bushels.

MR. LOW. I have heard of these wonderful experiments again and again, in New Jersey, in Iowa, in Rhode Island, and in Connecticut, and I affirm that they are big stories. If you have only enough manure, you can raise potatoes if the piece you plant is no larger than your thumb. But we have not enough manure. I am speaking of something that is practicable for the farmers of Connecticut. If your potatoes are of fair size, cut them once, give them plenty of manure, and you can raise three hundred bushels to the acre.

MR. J. STANTON GOULD, of New York. This is a controversy which has exercised the minds of farmers for years and years, not only in our own country, but in England, in Germany, and in every other country where potatoes are raised. I have a record of experiments innumerable, some of them stated in the most admirable manner, others stated in the most slovenly manner; and they are exceedingly contradictory. Some of them show that the largest yield has resulted from the planting of small sets; others show exactly the reverse. The misfortune with all the experiments I have seen—and I am sure I have studied many thousands of them—is that they have not been protracted. Farmers have satisfied themselves with experiments lasting for a single year; and when a decisive experiment, as Mr. Lyman's appears to have been, has been made, they have been entirely satisfied, and have never experimented again. That is the crying sin f our farmers that they do not seek to verify these experiments.

MR. LYMAN. I mean to follow it up on that line.

MR. GOULD. It will be an excellent thing if that idea is carried out. My object in rising was simply to call attention to a most admirable series of experiments made in Germany by one of the most philosophical observers, and most careful experimenters on all subjects connected with agriculture. This gentleman is Mr. J. N. Schwarts, of Germany. Looking over, as we have all done, these various experiments, and noticing the contradictory results which have been arrived at,

he determined that he would devote himself with care and assiduity to the final settlement of this question, and for years and years he followed up these experiments—weighing and measuring, noting the kinds of potatoes which he planted, and observing with the most scrupulous care all the circumstances which were incident to each experiment. I rose simply for the purpose of giving you the results of the protracted experiments which Mr. Schwarts has made. They are these:

1st. The amount of net produce, deduction being made for the quantity of potatoes used for setting, bears a tolerably exact proportion to the latter quantity; that is to say, that one who sets a larger quantity of tubers will usually obtain a more abundant crop than one who sets a smaller quantity.

2d. Fine large tubers produce not only larger potatoes, but also greater numbers of them.

3d. The degeneracy often observed in potatoes apparently results from the use of unhealthy plants for setting.

And let me remark, by the way, that this is the circumstance which usually vitiates the experiments which are made upon this subject. Farmers are not sufficiently careful to make the necessary physiological observations upon the condition of the potatoes which they plant, as they ought to do, in order to have their experiments clear and satisfactory. I do not know of any mode, except microscopic observations, which will enable a person who has never seen the potatoes growing, to go to a heap and select those which are in the most perfect physiological condition. This can be done by those farmers who raise potatoes, for they have an opportunity to notice the vigor of the vine and the growth and maturity of the potato; and they can always be sure, if they will take pains, to verify these three statements of Mr. Schwarts that I have read to you.

4th. Small tubers, and those which are destitute of buds, cannot be recommended for setting.

5th. When potatoes of a medium quality are planted, it is better to set them whole; but when the tubers are very large, the halves will be found sufficient, provided, however, that they are set rather closely in the rows.

6th. It is not advisable to cut a potato into more than two pieces.

7th. It is better to set the tubers one by one, and not close together, particularly when all the labor is performed with the plow, and no cultivation is given with the hand hoe.

8th. It is not advisable to plant mere buds, they often fail.

These experiments of Mr. Schwarts were quoted by an eminent agricultural writer of Germany, with whom, I have no doubt, many of you are familiar—Count Von Thaër—who verified them independently, and arrived at similar conclusions with Mr. Schwarts; so that we have the testimony of two independent observers, continued through a very considerable number of years.

The Bath Agricultural Society of England—and those of you who are familiar with the agricultural literature of Great Britain know that the Transactions of the Bath Agricultural Society are among the most valuable papers that are known in Great Britain—I have no doubt Mr. Gold, the secretary of this society, is perfectly familiar with them, and will bear me out in the assertion—the Bath Agricultural Society, in order to make this matter still more sure, had these experiments verified by that eminent physiologist, Dr. Anderson, whose experiments were made with the most careful precautions against error, and he showed, as the result of a great number of experiments protracted through many years, that the crop was proportioned to the weight of the sets, and thus verified this doctrine.

Colonel Mead, of Greenwich.—I am from a section of Connecticut that, forty or fifty years ago, ruled the city of New York in the article of potatoes. The town of Greenwich used to send to New York from five to seven hundred thousand bushels annually. When I first commenced, my crop was from five to six thousand bushels a year. Mr. Schwarts' conclusions, as stated by Mr. Gould, so well agree with my own experience, that I can not refrain from expressing my views in regard to them. We found it advisable to take our seed from high, dry ground, and plant in hills two feet apart, one potato in a hill, from the size of a turkey's egg to a good sized

potato. We generally preferred a sod. We commenced plowing the latter part of March, with sharp shares, not very deep, and when we wished to plant we plowed again thoroughly, and, very frequently a third time, until the ground was in perfect order, and then we furrowed it a little over two feet apart, put the potato the depth of the seed in the ground, and covered it sufficiently so that the earth would not wash away, and no more. As soon as we could see the rows the plow was started. I have very frequently raised crops of potatoes without taking a hoe into the field. Managed in this way, my crop for twenty-five or twenty-six years was from 300 to 360 bushels to the acre.

Dr. Baldwin.—Have you any opinion as to which end of the potato is the best for seed?

Mr. Gould. The seed end, undoubtedly.

Dr. Baldwin.—Why do you say "undoubtedly?" Is that proved by experiment?

Mr. Gould.—Yes, sir, again and again.

Mr. Day, of Brooklyn.—Thirty or forty years ago we farmers raised very much larger crops of potatoes than we can now, upon ground that was not cultivated any better than our lands are to day. In 1844 the potato rot first began to make its ravages felt in Connecticut, when, in consequence of the high price, the farmers were induced to cut their potatoes, to make a smaller quantity of seed answer their purpose. I want to ask if the falling off in the yield of our potatoes is to be attributed to the fact that we have planted small pieces, or whether some other cause has tended to produce these small crops.

Mr. Low.—My father always planted large potatoes, but his potatoes rotted notwithstanding; so I do not think that the rot originated in cutting the seed.

Mr. Gould.—I did not think of saying any thing on this matter. I want to make a remark or two upon the paper which was read by the gentleman who first addressed us. While I should go with him in most of his statements, I think they were not sufficiently guarded; that they require enlargement and amplification before they can be taken as sufficient

guides for the practice of our farmers. In the first place he tells us to plow deep. I agree with him there. He tells us in the next place that we can not harrow too much. There I am compelled to be at issue with him. Sir, what is the effect of a harrow? Road-makers understand that. We have men who devote themselves to the building of roads, and what do they do, after they have plowed up a road, in order to settle it in the most effective manner? Why, sir, they do not trample it, they do not roll it, they do not draw heavy sledges over it, *but they harrow it*. That packs the earth down more solidly than it can be done in any other possible way. While his statement is correct for sandy land, the object of the culture of which is to pack it rather than loosen it, his statement would be exceedingly injurious—would "lead to bewilder and dazzle to blind"—if it was applied to the stiffer soils. I maintain, from the result of large experience and observation, that there is no way of packing a stiff soil more completely than by the use of a harrow upon it.

What I would do, if I desired to lighten the soil, would be to employ one of the forms of the plow which are best adapted for the pulverization of the soil. There are a number of plows which are adapted to convert a stiff soil into an onion bed without any harrowing whatever; as, for instance, the plow invented by Governor Holbrook—the Michigan plow—which is now, I believe, sold in Boston. I speak of this with a great deal of confidence, because, under the auspices of the State Agricultural Society of New York, I have spent many weeks in the most careful and thorough trial of plows, with especial reference to the pulverization of the soil. I think we tried over forty, embracing almost every kind of plow known to the farming community, and it was found that on land plowed by one of Governor Holbrook's plows, a blunt stick could be thrust into the ground (which is the best test) to a much greater depth than where the land had been broken up by any other plow. This stood decidedly at the head of them all. It was absolutely unnecessary, for any other purpose than covering the seed, to harrow the ground at all after the use of that plow.

I understand the gentleman also to recommend the manufacture of superphosphates by farmers. I know it is exceedingly difficult to obtain pure superphosphates, and yet there are manufacturers who can be relied upon, and whose article produces the same result every time. But I want to caution farmers, that in counting the cost of home-made superphosphate they must add to the cost of the sulphuric acid, the bones and the labor, the price of a suit of clothes, a pair of boots, and the pain and discomfort of burnt hands. I don't object to the advice; I only want farmers, if they go into that manufacture, to do so with their eyes open. I think the gentleman himself will find that he can buy superphosphates much cheaper than he can manufacture them, if he is careful to purchase only of men who are reliable.

Dr. Baldwin.—I wish to correct the gentleman in one respect. I have made superphosphates enough, in the way I spoke of, to use on thirteen acres, and not a man had his fingers burnt, his boots spoiled, or a rag of his clothing injured. I don't believe that I got from the bone one-fifth of its value, but I believe it is in the soil, and if it is reduced to such a condition that it will bend between the thumb and finger, it will eventually be a benefit to the soil. It was worth double any superphosphate I ever bought for present use, and cost just about half as much. I have had some experience in buying superphosphate. I bought of one man, in two years, $230 worth, and I had the satisfaction of knowing that the state chemist decided that superphosphate to be worth six dollars a ton. I paid forty dollars a ton. The way I handle the acid is this. I take an old iron kettle and carefully pour the acid from the carboy into it. Then I put four pails of water into a kettle, and put the kettle containing the acid into the water. There is no flying or sputtering of the acid, and there is no need of spoiling any of your clothes.

I put the question, whether the seed end or the butt end of the potato was worth the most for seed, because I had tried that experiment. I cut two bushels of potatoes across, and planted the seed ends in two rows, and the butt ends in two rows. Of course they were just equal as to the number of

pieces and the number of hills. The result was, an equal number of bushels of potatoes produced in each of the two rows, but the rows where the seed ends were planted produced the largest number of very big potatoes, and a great many small ones; the rows where the butt ends were planted produced potatoes of an even marketable size.

In reference to the question put by Mr. Day, I will say, that I have no doubt the potato rot is a distinct and specific disease, resulting from a vegetable fungus, the seed of which is in the atmosphere, and is deposited upon the potato vine, or comes in some other way as yet unexplained. You might as well ask whether the yellow fever resulted from cutting potatoes fine or cutting them coarse.

Then the next question is, why is it that certain potatoes—as, for instance, the old-fashioned Silver Lake, which has gone out of date—seems liable to absorb disease more largely than any other potato? Just about the time of blossoming some of the vines will seem to have a kind of a blast upon them, and there will be no more growth of the potatoes in those hills. I have sometimes, when hoeing, dug up the hills that had that disease, and I have always found that the vine that manifested the disease came from the seed end of the potato. I have sometimes planted whole fields with butt ends, sometimes planting them whole, at other times cutting them into small pieces. I am satisfied of one thing—that the farmers about here use a great deal too much seed in planting potatoes; I do not know how it may be in other places.

Mr. Low. Facts are stubborn things, and I will refer to the practice of the farmers in Monmouth County, N. J., who supply the New York market with potatoes. There are many farmers there who raise 3,000 bushels a year. They use marl, and they know nothing of the rot there.

Dr. Baldwin. Do they raise the Silver Lake?

Mr. Low. I do not know about that. They raise what is called the Peach Blow extensively.

Mr. Lyman. Just one word here. I think you may find a solution of the problem in the fact that the farmers of this State do not change their seed often enough. I have studied

a little into the matter, and I incline to the opinion of Mr. Gould. It seems to me that the potato is just as liable to become diseased and to rot by planting the same seed year after year, as the human race is to deteriorate by a constant intermingling of the same blood. It seems to me that is the natural law of all grains and grasses. If any gentleman doubts this, let him send to Mr. Breese, next spring, for a barrel of his Early Rose potatoes, and plant them. I knew a gentleman who last year planted half a peck of the Early Rose, that came direct from Vermont, side by side with his own, and the potatoes from the Vermont seed were twice as good, twice as large, and twice as smooth. It seems to me that this shows that we have deteriorated our potatoes by neglecting to change the seed. Is it unreasonable to suppose that under these circumstances there will come, in the natural course of things, a rot and deterioration of the tuber itself? I doubt if our Secretary would find, in the whole State of Connecticut, one of the old-fashioned potatoes that our fathers planted. I have a neighbor close by me who used to plant the Silver Lake, which has been referred to, and he found they rotted badly. He got a few at Norwich last spring. and he said to me, "I used to like the Silver Lake a little better than any other potato, and I am going to plant these potatoes, and see how they will do." He planted them side by side with some Peerless potatoes that he had, and three-quarters of them rotted, and there was not another potato in his garden that rotted, so far as I know; showing that the trouble was in the potato and not in the soil. He had never planted that variety in his garden before.

MR. BALDWIN. I should like to inquire of the practical farmers here whether they are afraid of harrowing their land too much. If there is any danger in that direction, it will save me a good deal of labor.

MR. LOW. My father would never allow us to harrow. He wanted to keep the grass out of sight.

MR. GOLD. With regard to the Silver Lake, or Mercer, I would state that Gov. Hyde, two years ago, had some thirty different varieties planted side by side, and among them all,

there was scarcely one that was more healthy, or produced more abundantly, than this same old Silver Lake or Mercer. Its growth was just as fine as I remember it twenty years ago. And I understand that the produce this year continued to be healthy.

Mr. Reade. A year ago, I visited the farm of Dr. Hexamer, in New Castle, N. Y., and examined very thoroughly his mode of raising potatoes. I am quite sure that he plowed his land thoroughly and harrowed it thoroughly, because it was as mellow and as perfectly free from lumps as a beet bed, and I saw tools about there that suggested the kind of work he did. And certainly you who know Dr. Hexamer know that he is as celebrated in that line as any gentleman in the United States.

Mr. Gould. Does he not make use of the Nishwitz harrow?

Mr. Reade. I don't know.

Mr. Gould. If so my objection does not apply to that.

Mr. Reade. Any way, he pulverizes the soil as much as possible.

Mr. Gould. Precisely.

Mr. Reade. Well, we use the harrow in Eastern Connecticut to pulverize the soil, not to pack it.

Mr. Gould. There I think you miss your mark, by using the common harrow. It packs the soil underneath.

Mr. Low. It makes it look light on the surface.

Mr. Reade. I hardly think I shall give up harrowing yet. I have been practising it a great many years. I plow my potato ground well, and harrow it over and over again; and it seems to me that the finer and more mellow you get the top of your soil, the better. Have your harrow teeth sharpened every spring, so that they will go down four or five inches into the soil, and make it as fine as a beet bed.

Mr. Low. The experiment has been tried within half a mile of this very valley, with corn and potatoes, and the man did not get half a crop.

Mr. Reade. The soil might have been heavy, not light. I know of an experiment of this kind. A gentleman living near me had a field on which there was a large quantity of

stone. He spent four or five days clearing off the stone, and piled them up in the corner of the field. It was after he had sown his oats, but his crop was nearly twice as large on the land within three or four rods of this heap as elsewhere, and three years after, the clover was luxuriant there, when it had died out on the rest of the field. This shows me that some of our soils need to be packed. I have practiced rolling for a great many years with great success. I make the ground soft in the first place, and then roll it with a stone roller.

Mr. Gould. I expressly stated that there were some soils that required to be packed.

Mr. Reade. Then it is all right, for we are agreed.

Mr. Gold. Thomas' smoothing harrow has been recommended for the culture of potatoes. We used it last spring with excellent results. Just as the potatoes were coming up, we harrowed the field all over, and it answered the purpose perfectly—killed the weeds without injuring the potatoes.

Mr. Gould. Thomas' harrow is a capital one, if the object is not to pulverize the soil, but simply to destroy the weeds, when they first start to grow, and to make a smooth, even surface. No implement of husbandry has ever been invented which is equal to it for laying down and smoothing the surface in preparation for meadow. But the Nishwitz harrow is by far the best implement ever made for pulverizing the soil. Let any man who has a stiff soil go across it diagonally with this harrow, and then go over it in the opposite direction, cutting it into diamonds, and he will acknowledge, I think, that it is the most admirable implement ever used by the farmer. I have never heard a single dissenting voice. I have used it myself; I have heard the testimony of many others, and I have never heard any other opinion expressed. With regard to the old harrow, I would ask if every gentleman does not know that it is the invariable practice of road-makers, in order to settle their roads down, to harrow them?

Mr. Reade. I never heard of it before this afternoon.

A Voice. I can corroborate the statement of Mr. Gould in regard to the Nishwitz harrow.

Mr. Low. So can I, too.

Mr. Gould. What we want is to do the whole business with the plow. What is the object we have in view when we put the plow into the ground? It is to pulverize the soil. How does the plow pulverize the soil? That is the question which we want to solve, in order to ascertain what is the true plow to use, for everybody wishes to supersede the necessity for so much harrowing. Now, the way in which the plow cracks the soil and reduces it to powder is this. Every successive sheet of the soil must be made to turn in a certain curve, in such a way that one portion of the sheet shall travel faster than the other. [The speaker illustrated by diagrams on the blackboard the operation of the true plow, in cutting the furrow and disintegrating the soil.] The action of the true plow is to convert the whole furrow slice into powder. You can hardly, by the action of the harrow, more thoroughly disintegrate it.

Unfortunately, there is a tendency among plow-makers to fall into this mistake. When a farmer goes to one of them, he is assured that his particular plow will go through the ground and turn over the furrow with less, or no more labor, than any other, and the farmer is very ready to take it. He looks at nothing beyond the question whether the plow will run easily through the furrow. Gentlemen, I believe that is a great mistake, because the plows that run easiest are those which have the least of these bending qualities, this relation of curves, which I have explained, which is absolutely essential to the pulverization of the soil. The plows of this character turn the whole furrow over without bending it, and such plows ought not to be encouraged. Why is it that our farmers are satisfied with plows of this character? It is because we take our notions chiefly from England, and the *beau ideal* of an English farmer is to throw his furrows over at an angle of forty-five degrees, so that he can stand at one end of the field and look across an unbroken line, and any man who manufactures a plow in such a way as to break this even edge cannot sell one of his implements in England. The English farmer wants to make furrows which will lie up with sharp lines, and then he wants with his harrow to break off those

angles and fill up the interstices between the two furrows. But what we want is something that shall thoroughly break up and disintegrate the whole furrow, from top to bottom, so that, without any action of the harrow, we may have it in such a perfect condition that the sun, the air, and the rain can penetrate it, and act upon the different substances in the soil in such a way that they can serve as food for plants. That seems to me to be the true plan; and when you can have plows of this kind, I think you will be perfectly willing to abandon the old-fashioned tooth-harrow.

Dr. Baldwin. Does a plow in green sward run easier with a coulter on the beam or not?

Mr. Gould. Well, sir, you have asked me a very curious question. I will tell you the result of an experiment, although I hardly think you will believe me when I tell it. It was, however, made in the presence of Gov. Holbrook, Gov. Brown, Mr. Tucker, of the "Country Gentleman," Mr. Nourse, and several other gentlemen, interested in the manufacture of plows, who had assembled to see the experiments I was making, and they were as much astonished as I was. We plowed a furrow eight inches deep, having an exceedingly accurate dynameter, made for the purpose, to ascertain precisely what was the amount of power required to carry the plow through the land. We afterwards rigged the plow with a coulter, which went eight inches below the surface, so that the plow, running on top of the ground, drew that coulter to a depth of eight inches, and we found that the draft required to put the coulter through the soil did not vary a pound from the draft required to turn over a furrow eight inches deep. That experiment was witnessed by a large number of the best plow-makers in the United States. I repeated it again and again, with the same result. I can give you no philosophical explanation of it. When the result of our experiments went out to England, Philip Pusey, who has been president of the Royal Agricultural Society, and is one of the most intelligent and scientific agricultural investigators of England, repeated those experiments, and they came out precisely as ours did.

QUESTION. Does the double Michigan plow throw the bottom soil on top in pulverizing it?

MR. GOULD. That depends very much upon how it is rigged. Ordinarily, that is the case. Two inches (which is the best arrangement of the Michigan plow) of the surface sods, grass, weeds, and everything, is turned bottom upwards into the bottow of the furrow. A thorough mass of powder is thrown up on top of them, so that it is completely inverted; that is, if the earth is somewhat damp. When the soil is in a dry state, these circumstances are changed, and part of the earth falls back into the furrow.

DR. BALDWIN. Is it considered desirable to turn the furrow flat?

MR. GOULD. We in New York do not approve of flat furrows at all. The reason why I object to the flat furrow is this: that it leaves no channel for the conveyance of water underneath, which is a point very important to observe in plowing the soil. It not only allows the water to come in, but the air also. In order to convert the mineral matter in the soil into food for plants, it is absolutely necessary to form carbonic acid in the soil, and also another kind of vegetable acid, which is known to chemists as humic acid. These two acids can only be formed in consequence of the presence of the atmosphere in the soil. If the atmosphere is excluded these two substances cannot exist there. The humic and carbonic acid are the two substances which dissolve the mineral matters in the soil and place them in such a condition that they can be absorbed by plants. Now, when the furrows are turned so as to lap over, upon one another, a channel is left on the under side, which allows the water to drain off, and permits the air to enter, which generates these two acids.

DR. BALDWIN. Where would you put the manure in those furrows?

MR. GOULD. I should let the manure go where it wanted to. My impression is, if you are going to plant corn, for instance, and put on green manure, the best way is to spread it on top and plow it under. If the manure were thoroughly rotted, I should want to put it nearer the top.

QUESTION. Has Gov. Holbrook any plow that will give you your ideal of pulverization, at one operation, with a light pair of horses or oxen.

MR. GOULD. Well, sir, the most perfect plow that Gov. Holbrook has is his Michigan plow, No. 66, I think he calls it. That is the most thorough pulverizer of any. He has another one, which he calls his lap furrow plow, which does its work very satisfactorily, and which can be run with one pair of horses. I have seen his No. 66, where he goes twelve inches deep, drawn by a pair of horses, but they were very powerful Conestoga horses. His lap-furrow plow, however, can be easily drawn eight inches deep by a pair of horses, but its pulverization is not so perfect as his No. 66. That was the result of our experiments.

GOV. HYDE. What was the nature of the soil in which you experimented?

MR. GOULD. Our chief experiments were conducted at Utica, on the farm of Mr. Butterfield. It was thought desirable to repeat the experiments on soil of a different character, and we then went to the Connecticut river. The first series of experiments was conducted on a stiff, heavy soil at Utica; the second, on a sandy loam, also at Utica; and the third, on the tenacious loams of the Connecticut river; and they were conducted with the utmost thoroughness and fairness, many weeks being devoted to them. Going along before the plow entered the furrow, we put two pegs down, one on each side of the furrow. Then we made the horses walk very slowly, and as the plow passed along, we watched for the point where the transverse disruption took place, and found that it always took place instantaneously at passing one given point. We then measured off the slice, and tried to see how many inches in advance the one was of the other, and we found that on the most tenacious soil of Utica, this had to be reckoned eight inches in advance; whereas, in some more loamy soils, three and a quarter inches was the average required; and in some dry clay soils, I think it was only two inches. But you see that this would make an exact test of the degree of tension

required in order to produce the cracking of which I have spoken here.

QUESTION. Did I understand you to say, that the coulter alone required the same draught that the plow did without the coulter?

MR. GOULD. Exactly.

QUESTION. The beam, without any mould-board—just the simple coulter attached to it?

MR. GOULD. Just the simple coulter attached. The mould-board was taken off, and we had nothing but the sole of the plow. That experiment was tried with the utmost care, and was repeated by Mr. Philip Purly.

MR. READE. With reference to our soils here, can we dispense with the harrow for pulverizing?

MR. GOULD. You can pulverize perfectly, if you have your plow made right. With regard to the Nishwitz harrow, there are many cases where a meadow becomes hide-bound; you do not want to plow it; you want to get the benefit of all the sod you have got. Go over it with a Nishwitz harrow, and you can pulverize the top of it without destroying the grass; sprinkle over that your seed, and some top-dressing, and you will get a perfect renewal without plowing.

MR. READE. Now one word in regard to potatoes. Is not this a good plan for us here in Connecticut: to pick out our large potatoes in the fall for sale, then take the next size, about as large as a hen's egg, and lay them aside for planting, and boil the smaller ones for our hogs? Is not that a good system to act upon?

MR. LOW. It is not. Here is Mr. Lillibridge, who has planted large potatoes, and I stand as evidence of the fact that he has raised remarkably fine crops.

MR. GOULD. I do not wish to speak authoritatively upon the matter. I only give the results which have been arrived at with very great care, to which I have referred.

MR. READE. Your advice would be to discard small potatoes, use large ones, and cut them in two?

MR. GOULD. I dare not advise the farmers of Connecticut

what to do. I only state what the results have been, and leave them to draw their own inferences.

THE PRESIDENT. I have received a report made by Mr. Gould on the subject of plows, which I suppose is the most complete report on the subject which has ever been made either here or abroad. I really wish that every gentleman had it. I wish the state of Connecticut would publish it, and give it to every farmer within her borders. But with the present disposition to oppose appropriations for agricultural purposes, I think we cannot hope for anything so favorable.

MR. DAY. I want to thank the gentleman, (Mr. Gould,) from the bottom of my heart, for that grand illustration of the turning of the furrow and pulverization of the soil, which I have known all the days of my life must be done, but I have never seen such a complete illustration of it as we have had to-day I have never listened to anything more interesting and instructive than the gentleman's remarks upon plowing, and the illustrations which accompanied them. If we were to pass six days here, and have the whole of the time spent in addresses as interesting as his remarks have been, I should feel abundantly satisfied to sit here day and night.

MR. READE. I think the remarks of the gentleman from New York have been most appropriate, and I think the farmers of Connecticut may profit by them. I remember to have read in an old book, that Cæsar was asked "What is the most important thing about agriculture?" "Plowing." "What is the second most important thing?" "Plowing." "What is the third most important thing?" "Plowing."

Adjourned to seven o'clock.

Evening Session.

The meeting was called to order soon after seven o'clock, Vice-President Hyde in the chair.

The Chairman stated that the subject for discussion was

CORN,

which would be opened by a paper from Mr. Albert Day, of Brooklyn.

Indian Corn. Mode of Cultivation, Uses and Value.

Indian corn is our great native cereal, and its cultivation is adapted to a wider range of latitude and elevation than any other kind of grain.

It is found in the British Provinces, the dry plains of Mexico, the low and humid valley of the Amazon, and at the Equator, and wherever the mean temperature of the summer months is not below 68°.

From the extent of its cultivation, and the immense production, it may be considered as the most valuable of all the grains and the best adapted to the support of animal life. It has been said that " what the potato is to Ireland, indian corn is to the world."

As an article of food, it enters into daily use in many New England families, nor is the cheek suffused with the crimson blush, when our hardy sons and daughters are told that " all their bones are made of indian corn." From such a wide range of growth, it will be seen that it is not confined to any particular variety of soil. But in New England, a red loam that is not too dry is generally preferred as easier to work and at less expense, although as large crops are often harvested from the dark and the more tenacious soils when not overcharged with water, in which case they should be thoroughly drained.

The preparation of the land should not be forgotten, when we consider that at the time of its germination, the tender

rootlets strike perpendicularly down into the soil in search of food, and fix themselves there with little delay; this done the germ grows in the opposite direction and becomes developed into the stem and leaves of the plant.

The ground should be plowed when not too wet, and a plow having a conical mould-board leaves the land in a light condition, lets the air in, and is better than one which makes a flat, or level furrow. I have never seen the "Shares Harrow" excelled by any in use for fitting the seed bed and thoroughly covering the manure to a depth of two or three inches. It can be used lengthwise or across the furrows without turning up the turf, does not clog, is easily drawn, and is more effective with half the service.

Many good farmers spread their manure on the land designed for the next year's crop in the month of September. When the field is nearly level and the manure is not likely to wash off, it becomes incorporated with the soil, which induces a rich vegetation by May, or before the time of putting in the seed.

Others draw the manure to the field and place it in heaps to be plowed under or spread on the furrows and harrowed in, or to be put in the hill or drill. The long manure from the barn cellar or heaps beside the barn, is plowed under.

It has been a question with many practical farmers, whether more corn can be raised on a given space when planted in hills, or in drills, by applying the manure to the hill or drills or by spreading on the surface and plowing under.

The character of the soil, variety of corn, whether an early or late kind, must be the farmer's guide to a considerable extent. On cold, late land, manuring in the hill or drill usually produces the best crops, when upon the earlier and dryer lands, surface manuring produces better, is less liable to be affected by drought, with longer and better ears and less stover.

The depth to which manure should be turned under for a crop, and the influence upon succeeding crops, has been, and is, a question that has been often discussed. A favorite theory advanced some years ago was, to plow under the manure

to the depth of ten or twelve inches, and by some, more than that depth, with the assurance that the roots of the plant would reach it, &c.

Experience has taught some of the most practical farmers in Connecticut that this is wrong, and I hear it confidently asserted that surface manuring and harrowing under will produce better crops of corn, of oats, and grass, and continue to grow larger grass for a term of years, than where plowed under to a depth of six or eight inches.

The selection of good seed must not be forgotten. It should be gathered at the time of cutting up or topping, or if neglected at that time, at the time of husking. A stalk having two well-developed ears, with rows running regularly on the cob, and well filled to the end of the ear, is best.

At the time of planting, the land is marked in rows at right angles one to the other, and at a distance of three and one-half feet, or three feet and nine or ten inches. At this distance it can be worked each way with a horse and cultivator, which loosens the soil and facilitates the work of hoeing.

Various mineral and special fertilizers are used to give the germ an early and vigorous start.

Ashes and one tenth as much gypsum or plaster of paris mixed together, a handful to each hill, or one or two hundred pounds of superphosphate per acre, are of great benefit for this purpose.

Here I may be allowed to digress for a moment from the subject to speak of the worth of ashes upon land suited to their use.

In conversation with a gentleman who had given this matter much attention, I asked him what the cheapest fertilizer was. His reply was, "*Ashes, Ashes.*"

When sheep are kept upon the farm their manure should be carefully saved without being drenched, and composted with dry muck or gypsum. The droppings in the hen-house should be prepared in the same way, forming an excellent fertilizer to be used in the hill, but requiring the same caution in its use as Peruvian guano.

As a forage crop, corn is of great value, and many acres

are grown every year. In hot dry summers the supply of feed often falls short of the farmer's need. Corn sowed for fodder will supply this want, and if not wanted for soiling or autumnal use, it is one of the choicest and most nutritious kinds of food for cows, sheep, or other stock in the winter. Twenty-five tons in its green state can be grown on an acre, and about one-fifth of that amount when cured.

When grown for soiling or early fall feeding, it should be put in at different times, to keep up a succession of green feed.

White corn grown in the Southern States is used mostly for sowing for fodder, and produces abundantly; but large kinds of sweet corn produce nearly as large crops, which are much more nutritious, consequently inducing a greater flow of milk and more flesh.

When fed in a green state, it should be cut when the dew is off, and dried twenty-four hours before feeding. When cured for housing, it should be dried about two days, then bound in small bundles near the top of the stalk, and eight or ten of these placed in stacks around a common fence stake driven into the ground, and it will be cured to take to the barn or shed in three or four weeks of good weather.

It is not likely to be injured by storms if closely packed around the stake, and a sure protection is afforded if covered during wet weather with hay-caps, an article no good farmer can afford to be without.

The cost of cultivating an acre of corn varies with the season, character of the soil, value of the land, &c.

I shall take for a basis of cost an acre of land worth seventy-five dollars, and distant one or two miles from a city or large village, and the amount of crop sixty bushels.

Dr.	To plowing, harrowing, and marking,	$4.25
	planting, one and one-half day,	2.25
	hoeing, five days' labor,	7.50
	six cords manure,	18.00
	twenty bushels ashes,	5.00
	one hundred pounds gypsum,	.50

cutting up and husking, - -	6.00
interest on land, - - -	4.50
Cost of growing, - - - - -	$50.00
Cr. By 60 bushels corn, $1 per bushel, -	$60.00
1½ tons stover, $16 dollars per ton, -	24.00
half the manure and ashes charged to land,	11.75
	$95.75

leaving a net profit of $45.75 per acre for crop and increased value of the land for succeeding crops.

As the manure is produced on the farm, hence the low price charged for it.

That corn is a great exhauster of the land will be seen, when we consider that the average in the United States is increased from year to year, and the yield per acre continually growing less. Few practical men but have noticed the lightness of succeeding crops after the removal of a good crop of corn, and often a partial failure of grass seed to take root.

One reason for this is to be found in the fact, that magnesia, potash, and phosphoric acid, valuable elements of the soil enter largely into the composition of this grain.

By analysis it is shown that its nutritious qualities as food for the human family are, when compared with wheat, as 77 to 95; that it is rich in oil which is easily converted into fat, and in other elements which form the bone and muscle, making it the best adapted for working oxen and horses; and for fattening cattle, swine, and sheep, it is unrivaled in value by any other grain, besides furnishing a vast amount of material for our internal trade and commerce.

I have not the statistics from the Department of Agriculture at hand from which to show the number of bushels of corn raised in the United States the year preceding the time of taking the last census, its value, &c., the amount exported to different parts of the world, nor can I give an approximate estimate of the vast tonnage furnished by this cereal, and the uses to which it is converted.

That "cotton is king" may be reasonably doubted when we

consider the vastness and value of the corn crop, the immense amount of animal food yearly produced by its use, and the measure of wealth and comfort furnished to mankind.

The Cultivation of Corn.

BY WILLIAM H. YEOMANS, COLUMBIA, CONN.

In order to succeed to a high degree in the cultivation of *any* crop, certain conditions must be fulfilled. These are, the preparation of the soil for the introduction of the seed, the kinds of manure used, and the manner of applying the same, the after care during the growth of the crop, the harvesting of the same, &c. These vary in different crops, but as corn only is to be considered in this article, it is unnecessary to travel outside of the rules usually observed in *its* cultivation.

As to the preparation of the soil, it may be said that individuals vary, very much, since some prefer to plant upon the sod broken during the fall previous to the spring of planting, others upon the sod broken just before planting, and still others, in a course of rotation upon land previously prepared, by being sown to buckwheat one season, and followed the next season by potatoes, the season following being allotted to corn. But it is not unfrequently the case that a preparation of the soil is necessary, previous to the plowing, since it is abundantly proved that if any excess of moisture exists in the soil, maximum results cannot be expected. Soil unencumbered by an excess of moisture is naturally porous, capable of receiving the atmosphere which passes through it, unless the same is compact clay or firm subsoil. When, then, a soil is finely comminuted, and still retains the air spaces, it is, other things being equal, in the best possible condition to receive the small rootlets of the plant, which will then have no difficultity in spreading themselves; but the great difficulty is, far too many fields are almost wholly destitute of these favorable conditions, and must be brought to this state by artificial means. This applies to all heavy, compact, wet soils, and those having such a subsoil as retains more or less surplus

water which naturally, and very readily finds its way to the surface. The manner of ameliorating such fields is by thorough drainage, which takes all the surplus moisture, conducting it into the proper channels, where, instead of retarding the growth of plants, it may be appropriated to a legitimate use, and thus serve two good turns.

Premising that the primary condition of the soil is what it should be, the next point to be observed is the time and manner of plowing, and whether of greensward or not. If the former, then should this be done in the fall or spring? One argument used for fall plowing, is, the destruction of grubs and worms that naturally exist in the sod, and also the comminuting effect of the frosts of winter, and exposure upon the broken surface. So far as this goes it is perhaps beneficial; but at the same time, it is generally admitted that but little effect is produced upon the sod itself towards reduction, and in fact it is not so susceptible to the influences of decomposition, in consequence of which the greater liability of the grass to spring forth increases to a considerable degree the future care of the crop. Nor is it believed that the plea of attraction of living worms to its roots, thus saving the corn, is a sufficient recompense for the additional trouble. One fact is certain—that spring plowing of such fields must be wholly omitted, or the sod will only be again turned to the light; then harrowing must be resorted to, which, as is often observed, proves to be in a great measure inefficient, and hence in the end a loss of labor is the result. On the other hand, if the sward be turned in the spring, and that, not until the young grass has considerably started, the effect is to induce fermentation, and the early decomposition of the sod is the result. At this point a question very naturally arises regarding the depth to which it is proper to plow, and which as applied to breaking of sward land can be answered, that it should be of sufficient depth to allow a good amount of loose soil to rest upon the sod; but passing to fields under culture, the answer depends wholly upon the depth of soil; and this is the rock upon which the advocates of deep and shallow plowing split, as they do not usually make proper distinctions in this direc-

tion. Thus, if a soil is very deep the principle of comminuting the soil whereby greater latitude is given to the roots of plants, would at once point to a great depth of plowing if properly done; while on the contrary, if a soil is shallow, nothing could be more injurious or perhaps destructive to the succeeding crop than to plow to a great depth, burying the available surface soil beneath a large body of soil that had not yet been properly prepared for plant food. In such cases the transformation should be gradual from year to year, until finally the desired depth can be attained. There can be no doubt that where all the conditions are favorable, deep plowing should be approved and practiced, since the greater the amount of soil the plant has to work upon, other things being equal, the more favorable the results. Now if the crop of corn is to be planted upon what is termed old land, it might be appropriate to consider somewhat the time and manner of plowing this. Upon tho principle that the atmosphere and frosts of winter act as disintegrators, it would undoubtedly be advisable, if other circumstances would allow, to plow such fields late in the fall, just before the setting in of winter, whereby it becomes more easily acted upon by the rays of the sun, and hence more readily worked, and that too, considerably earlier in the spring. If such course should be pursued, plowing should invariably be done in the spring also, which leaves the land oftentimes in far better condition than where the fall plowing is omitted.

Passing now to manuring, important considerations present themselves. In the first place, the *best* fertilizer that can be used upon any farm-crop is the manure made upon the farm, and this should at all times be liberally bestowed. If plowing of greensward is done in the fall, then the manuring should naturally be made in the spring. One general principle should be observed in the application of manure, that it be so made as to be most available for the plant; then if the case is as above, this can more naturally be done just before planting in the spring, being thoroughly incorporated with whatever fine dirt remains above the sod. If the sward be plowed in the spring, then it would be advisable to spread thickly the

coarse and green manure before plowing, which as decompo sition progressed and the gases were generated, these could be taken up and thoroughly disseminated through the sod. but manuring should not rest here. Before planting, the more finely comminuted manure should be spread upon the surface and thoroughly incorporated with the soil previous to planting. Again, upon the supposition that the field has been previously cultivated and is to be plowed in the fall, if manure is at hand, it would be highly desirable that a quantity be spread and plowed in, as thereby all its parts would be thoroughly disseminated throughout the soil. But omitting this and passing to spring plowing, this should be preceded by a liberal supply of coarse manure evenly spread upon the surface, and then before planting let the fine manure of the yard be spread and thoroughly harrowed in, and if the applications have been sufficiently liberal, the field is ready for planting. The surface should be marked perhaps both ways, at least three feet apart, as it is believed that the size of the corn more than compensates for the extra number of hills gained by closer planting. Having the surface marked, then comes the question of manuring in the hill. It was formerly believed to be the best policy to spread on manure lightly and then use a large quantity in the hill; but later experience has demonstrated the absurdity of such practice, for the reason that as soon as the corn obtains a fair start in life it sends out its roots in search of sustenance, but the manure in the hill being contained in a limited compass is soon left, and so does not become available for food for the corn; therefore it is that during later years the practice has been rather, to spread a large proportion or the whole of the manure of the yard, and in the hill use some powerful compost, or commercial fertilizer, in small quantity, which, acting as a stimulant, occasions such rapid growth early in the season, as to force the roots in all directions, whereby they are enabled to drink in the fertilizing elements that have by that time become better prepared for their use. An application of ashes is frequently made, by spreading the same upon the hill, which has a very beneficial effect upon the growth of the corn. Whenever the above

mode is carefully and thoughly practiced, other things being equal, no fears ever need be had regarding the result.

The corn being planted, which should be carefully done, being covered by about an inch of fine soil, and well started in growth, the legitimate care of the same commences. This consists in hoeing, keeping clear of all weeds or foul growth, and sufficient stirring of the soil. To keep perfectly clear from weeds is one of the great essentials, for it is hardly considered to be good husbandry to thoroughly prepare a field for a crop of foul growth. Of the stirring of the soil, it is hardly possible to carry the same to excess, since it is a fact, that a good proportion of the food of plants is derived from the atmosphere in the form of gases, and it is also a fact that fresh earth has a greater power for abstracting these from the atmosphere; therefore the greater the amount of fresh surface of earth exposed, the greater the volume or quantity of gases absorbed, and hence a larger amount of plant food obtained.

It is always desirable that the seed should be of the best quality, and this can be secured by a proper care in selection; and it is now generally believed that not only corn but other crops can be greatly improved in quality as well as quantity by careful selection and cultivation.

Perhaps it ought to be stated, that the time of planting should be regulated in a great measure by the season. At all events, it should be postponed until the ground is thoroughly warmed, and all danger from frost is passed. If planting is done before the ground is sufficiently warmed, the seed is liable to decay; but if planting is postponed later, as the ground is then warm, the young corn grows rapidly and is oftentimes more advanced than that considerably earlier planted. Fields of corn are often planted the first of June, and they have been known to have been planted as late as the tenth of June, from which good results have followed. Taking into consideration the average period of growth of corn, perhaps no better rule can be adopted than to plant at such time as will be sure to allow of ripening previous to the first fall frost.

Upon the point of harvesting there is considerable difference of opinion as well as practice. There are three general methods in use, viz: topping off the stalks, or cutting the same just above the ear; cutting up at the roots; and letting the same stand upon the hill until thoroughly ripened before cutting. In the first of these, the desire is to save the stover in better condition, upon the supposition that the corn will ripen equally well, but which leaves the bottom stalk nearly worthless. The second is believed to save the bottom portion of the stalk equally well with the top, assuming that the corn ripens equally as well as though allowed to stand upon the hill. In the third, both are left upon the hill, because it is believed that although the stover is more or less injured thereby, the weight of corn is considerably augmented in consequence of such practice. Each of these courses has its advocates; but certain experiments, all of which in results tend in one direction, are in favor of cutting up by the roots just after the kernels of corn are seared over. But notwithstanding the pointedness of these results in one direction, probably one half the corn planted in this state is topped. Of different experiments tried, although somewhat varied, the results all point to the same end. In one the result was only about four per cent. in favor of cutting up over topping, and six per cent. in favor of cutting over letting stand on the hill. In another the result was more favorable, being seventeen per cent. in the second case and thirteen in the first. In still another, the percentage in favor of cutting up was about seventeen. In this case, as it was claimed that the greenness of the corn made a difference, all was allowed to remain until thoroughly dried, and by weight the result was in favor of cutting up by about twenty-one per cent., and in this last an attempt was made to satisfy the question of the relative value of fodder in each case; and the result was, that while it was evident that the portion allowed to remain with the ear is mostly changed to woody fibre, that those stalks cut up by the roots were equally as good, as a whole, as the tops taken off above the ear. But returning to the corn, one fact was noticable in all the experiments, and that was, that while the corn topped was less

valuable than where cut up by the roots, that allowed to stand with the whole stock was still less valuable—that is, less valuable than where topped—which goes a long way to prove the proposition of Baron Liebig, who has stated that "all plants left in a natural state to mature their seeds, give back to the earth, in the form of excrementitious matter, a portion of their seed forming substance, thereby diminishing the weight of the grain or seed." Thus it is seen, that where a portion of the stalk is removed, there is less diminution in weight than where the whole is allowed to remain. Thus the inference may readily be drawn, that where the stalk is cut up, the connection with the earth being severed, the juices in the same that would naturally pass back to the earth, are conveyed to the corn and thereby add to its weight. If this point be satisfactorily proved, if all those persons who now top their corn would cut the same upon the hill, quite a considerable addition would be made to the aggregate amount of the crop in a single state.

To pursue the investigation of this subject further, taking into consideration the general exhaustion of the soil, as the result of the growth of a full crop, and consequently the amount of matter to be returned to the soil, or previously applied, in order not only to maintain an average fertility but also to increase the same, is treading upon uncertain ground, especially to those who make no special pretentions to scientific attainments; and still, with the present advancement of science, and especially of chemistry, in its connection with agriculture, something like an approximation can be made of what is necessary to be done in the raising of corn.

There have been formed approximate tables of the amount in pounds of inorganic substances of manurial value, removed from an acre of ground by average crops, supposing the whole crops to be taken from the field, and by means of these tables, the amount taken by a crop of corn is stated to be 247 pounds of a combination of potash, soda, lime, magnesia, phosphoric acid, sulphuric acid, silica, and salt, of which compound potash, phosphoric acid, and silica make up nearly 180 pounds, or nearly three-fourths; so that, if these estimates are correct,

and making a double allowance for an extra crop instead of an average one, about 500 pounds of mineral substances could be removed, of which the three named would compose about 375 pounds, and therefore if a restoration was to be effected by means of commercial fertilizers, it would be necessary to employ one in which potash, phosphoric acid, and silica were largely in excess; but as the latter of the three is plentifully supplied in most soils, it will be necessary to have more regard for the two former; but as it is generally conceded that barn-yard manure is the most natural fertilizer that can be used upon any crop, it is necessary to consider the relative constitution of that material. It is laid down, that in barn-yard manure well rotted and dried, the principal ingredients heretofore named exist in about the proportion of ten per cent.; so if an estimate of the amount of moisture contained in barn-yard manure can be made, which is known to be exceedingly great, then an approximate basis for a calculation of the relative qualities of the principal manurial substances required will be had; and having found these, the required amount of manure is easily estimated and therefore applied. But it is seldom that the ordinary farmer feels qualified for the performance of any so difficult task, and hence simply uses his best judgment in the application of his manure, which answers the purpose equally well if his judgment only leads him to make a *thorough* application. The difficulty in such cases usually consists in a desire to make the most of what is possessed, whereby the same is used upon so large a surface, that notwithstanding enough is absolutely furnished to restore the waste effected by the growth of the crop, no provision is made for a gradual improvement of the soil, which should be a matter of high consideration and never lost sight of. The corn crop is not as exhaustive to the soil as many others, which also take substances in different combinations; hence the benefits of a rotation of crops, which should always be so arranged as to require substances that have been least used by the preceding crop, so that while exhaustion is going on in one direction, accumulation is likewise going on in another.

Passing to another point, the feeding value of corn and of

the fodder, and a field of investigation is opened the extent of which affords ample opportunity for difference of opinion.

In considering the stover or fodder, the general impression ever has been that it possesses no inconsiderable value for the purposes of increasing the flow of milk among dairy cows, and although Dr. Loring has expressed the opinion that corn fodder possessed little value or was worthless, farmers still continue not only to preserve that from which they take their corn, but also to raise it in no small quantities for soiling and fodder purposes. In fact, the impressions are so favorable towards this product that its growth has been very much increased within the past few years, in which, in consequence of the somewhat severe drouth, it has exercised a very important office, in not only relieving the pasturage in which the herbage was scanty, but also the limited mow of hay. It is a matter of surprise that any person should venture the assertion that corn fodder is worthless, since it is sufficiently established that the corn plant, like all other vegetable structures, has but one object or aim in its growth, which is the production of seed. And the stalk, to effect this end must contain starch, gum, sugar, and woody fibre, the former of which are nutrient principles. If, however, the stalk be cut before a sufficient time has elapsed for the elaboration of any of the nutrient principles, then its actual value is diminished in proportion as these principles are wanting; but if allowed to continue its growth, whenever a sufficient amount is stored away, and the grain formed, the end of its existence is accomplished, and the plant dies, even though no frost has assailed it.

Of the grain itself it may be said, that it is the great feeding crop of this nation. The great and increasing demand for it is in itself an argument as to its value; and though in New England it is gradually giving way to other crops, it is not because it is not highly esteemed, but because upon this rugged soil other crops more profitable can be grown, with the avails of which, the corn that is transported from the south and west is more easily purchased than raised; so that, while only a quarter of a century ago the established farmers had an abundance of corn for their own use in the affairs of their

farms, and a quantity to sell in the market, now the rule more generally is for the farmer to go to market with the cash that he has received from his tobacco or some other crop, and purchase his one or five hundred bushels of grain to be used upon his farm. But it is unquestionably a fact that in earlier times, much less of this grain was fed than at the present time, especially to neat stock and horses, as the opinion then prevailed that the stock must be wintered upon the hay and coarse fodder that the farm afforded, leaving the swine to consume the corn. Now, however, all stock alike share the consumption of corn in some shape, and though it is usually shelled from the cob and ground, leaving the cob to be burned, from analysis it appears that there is about the same amount of organic matter in the cob that there is in the grain; about one-tenth part as much of the albumenoids, two-thirds as much of the carbohydrates, and one-fifth as much fat; so that it would appear that it may yet become a matter of economy to grind corn and cob together for feeding purposes, especially when fattening is not the principal desideratum.

As to the relative value of corn, taking good English hay as a basis of comparison, assuming the hay to stand in the scale at 100 and corn would stand at about 50—that is, fifty pounds of corn as ordinarily fed would be equivalent to one hundred pounds of hay. In a lecture on cattle food, at Cirencester Agricultural College, England, corn was placed at 60 in comparison with hay at 100; but recent experiments go to show that the value for feeding purposes of corn as well as all other kinds of food is greatly enhanced by being cooked, for reasons as stated in the results of experiments made by MM. Raspail and Biot, of the French Academy of Sciences, as follows:

"1. That the globules constituting meal, flour, and starch, whether contained in grain or roots, are incapable of affording any nourishment as animal food until they are broken.

2. That no mechanical method of breaking or grinding is more than partially efficient.

3. That the most efficient way of breaking the globules is

by heat, by fermentation, or by a chemical agency of acids or alkalies.

4. That the dextrine which is the kernel, as it were, of each globule, is alone soluble, and therefore alone nutritive.

5. That the shells of the globules, when reduced to fragments by mechanism or heat, are not nutritive.

6. That though the fragments of the shells are not nutritive they are indispensable to digestion, either from their distending the stomach, or from other causes not understood; it having been found by experiment that concentrated nourishment, such as sugar or essence of beef cannot long sustain life without some mixture of coarser or less nutritive food.

7. That the economical preparation of all food, containing globules or *fecula*, consists in perfectly breaking the shells and rendering the dextrine contained in them soluble and digestible, while the fragments of the shells are at the same time rendered more bulky, so as the more readily to fill up the stomach."

These principles were very happily illustrated by a series of experiments very carefully conducted by a farmer of Iowa, in the fattening of twenty hogs, being first fed twenty-eight days on dry shelled corn, in which they consumed 83 bushels and gained 837 pounds, selling the corn at .50$\frac{4}{10}$ per bushel; they were next fed fourteen days on dry meal, in which they consumed 47 bushels, gaining 558 pounds, selling the corn at .58$\frac{8}{10}$ per bushel; they were next fed fourteen days on meal mixed with cold water, consuming 55½ bushels, and gaining 731 pounds, selling the corn at .65$\frac{8}{10}$ per bushel; they were next fed fourteen days on cooked meal, consuming 46½ bushels, and gaining 696 pounds, selling the corn at .74$\frac{8}{10}$ per bushel. Taking the two extremes, after deducting the toll for grinding, leaves .21 per bushel in favor of cooking; and if the food for the hogs had been all cooked it would have made 663 pounds more, which would have been worth $33.00 more. Or while it would require 345.51 bushels of dry corn to make 3,480 pounds of pork, it would require only 232 when cooked; a difference of 113.51 bushels in favor of cooked food. This is only one of a thousand experiments

of the kind that have probably been made throughout the country, and which assist in proving the importance of cooking food. It will be noticed by the first experiment that one bushel of dry corn will produce ten pounds of pork, which may be taken as a fair average for the purpose of establishing the value of corn when dry for feeding purposes.

MR. GOLD exhibited some ears of corn, produced by MR. B. H. ANDREWS, of Waterbury, by crossing the Early Vermont, Early Prolific, and Ohio dent corn. The ears were large and well formed, and reported as very early.

DR. BALDWIN. I should like to inquire of Mr. Day, which he would prefer to undertake to do, to raise sixty bushels of corn on one acre, or thirty bushels an acre on two acres?

MR. DAY. I should decidedly prefer the sixty bushels. I always go in for the largest crop. In the first place it does not cost any more to plow an acre of ground to produce sixty bushels than it does to plow an acre that will produce thirty bushels, and it is so much more profitable to raise sixty bushels than it is thirty, that I have always adopted the maximum crop, whenever I could get it.

DR. BALDWIN. The *getting it* had something to do with my question. How often do you get the sixty bushels?

MR. DAY. Well, sir, in the course of my cultivation, not very often. Thirty, forty-five, and fifty bushels are my largest crops. A few times in the course of my cultivation, I have gone as high as seventy or eighty bushels. I consider, Mr. Chairman, that the only way a man can cultivate a crop to any profit is to cultivate for a maximum, and use every effort to attain that end. I believe I have answered the doctor's question.

DR. BALDWIN. Have you not got the estimate of the fodder, $16.00 a ton, too high? Can you reasonably expect to get $24.00 worth from an acre of corn?

MR. DAY. My impression in regard to that is, that a ton of stover well cured and well taken care of, is worth two-thirds the price of English hay. I think it will produce as much flesh, and as much or more milk, than that quantity of

hay, and for that reason, I estimate it as worth $16.00 a ton when hay is worth $24.00 a ton.

Dr. Baldwin. Have you not made an error in your estimate of the comparative value of sweet corn and southern white corn, or Maryland corn, for feed? I understood you to say that you thought the sweet corn was the most profitable. Have you found that to be practically true?

Mr. Day. In reply to that, I will say, that I have always considered that what the human family like, the animal creation relish and like; and I believe that a cow, an ox, or a sheep relishes the stover from sweet corn as much more highly than the stover of southern corn, as the human family do sweet corn over and above the common or the southern corn. I believe it is altogether more rich in nutritious matter.

Mr. Low. When I first went to New Jersey to teach school, I was much surprised to find that the farmers did not feed any hay to their cattle; they wintered them entirely on corn fodder. I am now milking seven cows, and I find that corn fodder makes more butter than anything else that I feed.

Mr. Hart, of West Cornwall. Our soil is somewhat different from the soil which Mr. Day and Mr. Yeomans work upon, in respect to the cultivation of which they have given such intelligent directions. Our practice is not to plow very deep. In my own practice, I have secured the best results by plowing in the spring; breaking up the turf to the depth of about five inches—putting my manure on previously to plowing—and then, as the turf decays, it furnishes a large amount of vegetable matter that is in just the condition to feed the corn as it comes along and requires it in its various stages of growth. I am not raising corn now at all, being engaged in the production of milk, and supplementing my hay crop with sowed corn corn-fodder; but my crop, when I planted corn, exceeded sixty bushels to the acre, and twice I have been above a hundred bushels. I think I took the first premium that was awarded by the State Society for a crop of corn, which was one hundred and two bushels. I am decidedly of the opinion that it is better to raise a good crop on one acre than a poor crop on three acres. I think the present results

are better to raise seventy-five bushels on one acre than to raise the same quantity on three acres, and the results in the subsequent crops of vegetables, cereals, and grass are more valuable than those following smaller crops.

The practice usually is to raise corn the first year after turning over, following with oats. Formerly, our farmers used to seed down with spring wheat, but that has been dropped. Usually, in my own experience, the crop following, oats, has averaged, until within a few years, about sixty-five bushels to the acre.

On the question of sowed corn, I am decidedly in favor of sweet corn. I planted the past season a couple of acres of sweet corn, and something more than that of southern corn, and the result with the sweet corn has been very satisfactory. I should not estimate the stover from ripened corn as valuable as Mr. Day found it, but I think the quantity from a crop of sixty bushels would exceed the quantity he gives.

MR. DAY. Allow me to make one correction. I supposed, all the time, that that stover was to be well cured and well taken care of. I do not mean that it should be cut and carelessly or slovenly stacked, and left out exposed to all the changes of weather until the first of November, when I will agree with anybody it must be comparatively worthless.

MR. HART. Our best farmers believe in doing what they do well; they think it pays the best. Grass is our specialty, and the object of our best farmers is to raise the largest quantity of grass of the best quality they can. They commence by clearing the stones from their fields in most instances, planting with corn, cultivating the year following with some cereal that is best adapted to seeding lands, and then following with grass. The result of this method with us—the dairy business being our specialty—is, I think, better than any other.

QUESTION. About how thick would you plant corn for sixty bushels to the acre?

MR. HART. I planted three acres, the rows three feet apart each way. The result was sixty bushels of shelled corn to the acre.

QUESTION. About how many stalks remained in a hill?

MR. HART. From three to five. In another part of the same field, where I raised a crop of one hundred bushels, it was planted two and a half feet apart in the row, and the rows three and a half feet apart. It was on a southwest inclination, so that the rays of the sun would penetrate it, and the growth was large. The corn was soaked in water saturated with saltpeter, and favorable weather was selected in which to plant it. It showed itself in four days, and in five it was quite perceptible; in six, you could stand at the end of a row and see the young blades of corn the whole length; and its growth was in that proportion all the way through.

QUESTION. How much manure did you use?

MR. HART. Twenty cart loads to the acre. I think Mr. Gold adopts a somewhat similar practice, as do many of our farmers. We have a rugged soil, and when we clear off the stone, it is a darkish friable loam, resting upon a hard-pan sub-soil, but very productive, where thorough work is made of it.

QUESTION. I would like to inquire whether the gentlemen present have found any difference in the yield of different kinds of corn? I think that is a matter of some importance.

MR. HART. I would say that the corn that I raised for a great many years was the Dutton corn. The seed was procured of Judge Buell, who was formerly editor of the "Albany Cultivator." I think my father was the first person who introduced it into this state. The ears came eight inches long, and with from twelve to twenty rows on an ear. My father adopted the practice of selecting his seed corn when cutting it up, from stalks that had two ears upon them, intending to decrease the size of the cob, and increase the length of the ear, in which he succeeded to such an extent, that finally we often came across ears of the Dutton corn fourteen inches long. This variety was extensively disseminated through Litchfield county, and even sent to other parts of the state.

QUESTION. I will inquire of Mr. Hart if he invariably took his seed corn from stalks that had two ears?

MR. HART. I did, for years.

QUESTION. Did it produce stalks with two ears?

MR. HART. In a great many instances it did. From year to year, the number of stalks that produced two ears to the stalk increased.

DR. RIGGS. I live near Hartford, and I have not gone into corn statistics as much, perhaps, as I ought to have done. With tobacco bearing so high a price, we find it more profitable on our soils to raise tobacco and buy our corn than to raise corn for our home consumption. To subdue land, however, I frequently plant to corn, and generally have a small piece every year. This year, I had about four acres of land that I suppose had not been plowed for twenty or thirty years. It lies a little inclined, and the soil above it was a light sandy loam, just right for tobacco, from six to eight inches deep, these resting upon a sub-soil of red gravel, containing a good deal of iron. This gravel runs down then, so that a well dug upon the upland where the houses stand, enters the clay hard-pan at the depth of thirty or thirty-two feet. This ground from the well begins to slope to the east, at a very slight incline—so small, that it is fine arable land, and raises the best tobacco. Below this, this particular stratum of soil, resting on the gravel, seemed to stop, and this red gravel began to crop out a little, and from that came small rivulets of water, springs bubbling up in the spring in several places along the lot, and running down on to this almost level land. I found it necessary, in order to make it cultivatable at all, to underdrain; and this last spring, I took hold of the job. I broke that up with a double Michigan plow. The wild grasses had extended their roots quite deep, and were just like wires. I had three yoke of oxen part of the time, and part of the time I used a pair of heavy horses and two pair of cattle, breaking it up as near as I could to the depth of ten or twelve inches. I am not afraid of deep plowing. I put no manure upon the surface, because the sod was so thick that, as soon as I got the water off, I knew that the fermentation and heat of the sod would produce plant food enough. Before planting, I covered the surface with barn-yard manure, made from hay, corn-fodder, cotton-seed meal, and some corn.

I had a very rank and heavy crop, but I did not measure it. I invariably cut my corn up at the root at the proper time, in order to secure the stover in its best condition. I planted the common corn, for I have found that you can hardly go amiss, in the state of Connecticut, if you plant that kind of corn. I have raised ears a foot long.

I think that, for raising corn, plowing in the spring is preferable to plowing in the fall, because we get a fermentation of the sod, and it is a great help in our backward springs towards starting the corn forward. I commonly use the Billings' corn-planter in putting in my seed. A man who understands the business, can, with a good horse, plant five or six acres in a day with that machine; and besides, you can put into the seed-planter your fertilizer—superphosphate, ashes, or whatever it may be, if it is fine—and start your crop forward immediately. I soaked my corn this year in sulphate of iron—that is, copperas—and the corn appeared above the ground the fourth day, I think, and went ahead rapidly. Thre was a very large growth and a very satisfactory crop. My corn-crib is in a very satisfactory condition. On a portion of the field, where I put no fertilizer on top, I sowed five or six bushels of salt to the acre, and the corn upon that was not so large nor so heavy as upon other portions of the field.

Mr. Hart. This question of deep and shallow plowing for corn, is one of a great deal of interest. If any gentleman speaking upon the subject has any facts in relation to the results from either mode of plowing, I wish they might be called out here. For my own part, I think the nature of the soil has a good deal to do with the result. With me, comparatively shallow plowing has had the best results. An instance in illustration occurs to me now. On one occasion I gauged a plow for my hired man, to cut a furrow about five inches deep. One-third of the field was plowed just about as I had left the gauge in the morning, but when I went to the field at night, I found that he had been plowing half the day eight inches deep, right round the field. I said, "What are you about? You have been altering the gauge of the plow." The man said, "Your brother came along, and said, 'you are not

plowing deep enough,' and gauged it deeper." I set it back where it was, but during the whole process of cultivation and harvesting, I could distinguish the rows which were plowed while the deep draft was on the plow. The corn was far inferior in its appearance while it was growing, and the results in the basket were noticeable as being much less than where it was plowed at the first depth.

Mr. Gould. I have one or two facts which I can vouch for, upon the question of deep or shallow plowing for corn:

In 1865, I was appointed by the Agricultural Society of the State of New York a Commissioner to visit the Western States with reference to the study of sorghum. It then appeared that it would be necessary for us in New York to raise our own molasses, and it was with that point in view that I was sent there. The year 1865 was signalized in the agricultural history of Illinois by one of the most extensive and devastating frosts in August that have ever occurred in that state. A very large portion of the corn crop was cut off; never ripened at all, and was no sort of use to the owners. In order to examine the sorghum, I obtained from Mr. Ogden, the President of the Central Railroad of Illinois, a hand-car, and some Irishmen, so that I could stop at any of those sorghum fields that I desired, and acquire information in regard to them. In that way, I was enabled to make such a careful personal examination of the State of Illinois as very few persons, in so short a time, were ever able to do. I noticed on that occasion, that while an extensive tract of country all around was devastated by these frosts, I would occasionally find a field that was perfectly green and beautiful, and the corn just as good as could possibly be desired. This would sometimes be the case in a field surrounded on every side by fields destroyed by the frost. Of course, in those circumstances, I made very diligent inquiry to ascertain the circumstances under which this corn was saved while the other was destroyed, and I invariably found, that the land where the corn had been saved had been plowed deep with a Michigan plow. That was the uniform statement. The same frost that cut off the corn also destroyed the sorghum, and I found

the same fact in relation to that—that there were fields of sorghum perfectly good, yielding a rich and genuine juice, surrounded by fields utterly destroyed. The answer to the inquiry was always the same—it had been plowed from seven to eight inches deep. That is a fact that I can vouch for.

Well, sir, take the valley of the Scioto. Every one knows the value of that valley for the purpose of raising corn. I suppose there is hardly such another region upon the face of the earth. The early settlers there never plowed their land. You can hardly say that they tickled it with the plow. They ran the plow along, and just lifted the ground a little. The result was, that even with that imperfect and miserable cultivation, they raised no less than seventy bushels to the acre. After a while, it began to fall off, and the average crop now in that valley is not more than forty bushels to the acre. Mr. John L. Gill, of Columbus, Ohio, plowed one of those fields with a Michigan plow, to the depth of eight or nine inches, and raised one hundred and twenty-five bushels to the acre, while the farmers all around were raising but forty bushels. I have seen the same result again and again. I have no shadow of doubt, that the true way is to plow, and the deeper the better, provided the soil is not in a poisonous condition.

Having laid down the general proposition, I will modify it by the conditions which I think ought always to be annexed to a statement of this character. If, for example, there are four or five inches of soil, and then rock underneath it, I would not recommend plowing three inches into the rock. If there were four or five inches of good soil on top, and a layer of iron pyrites underneath it, I would not exactly recommend going down ten or twelve inches on that land. If it was a heavy, solid, cloggy clay, I would not recommend putting the plow in twelve inches all at once; but I have never yet seen (and my life has been devoted to the examination of these facts, over a large area)—I have never yet seen a soil where it was not safe to take up an inch of the sub-soil every year, where there is this poisonous or injurious matter in it. It is in this way that I have seen the greatest ameliorations of the soil produced. I have invariably found that plowing in the

fall was altogether the best practice, that the poisonous matter that was thrown to the surface might have the ameliorating influences of the winter frosts, in order to improve it. I have invariably found that a decided amelioration of the soil has taken place where the depth of sub-soil taken up was limited to one inch. I have, therefore, no hesitation in saying, that where this special circumstance does not occur, (and I believe I am borne out by the fullest and most ample experiment,) the deeper you plow, the better.

I can very well understand that there were in the sub-soil to which the gentleman has referred, where he ran his plow eight inches deep, injurious matters; but I venture to predict, that if he continues that operation for a few years, until that sub-soil has become thoroughly ameliorated by the action of the atmosphere, he will find a marked difference between the land plowed eight inches deep and the other. Of course, it was ill-judged husbandry to go so deeply at first, but persevere.

Many years ago, one of the most able, I think I may say, *the* most able and ingenious experimenter in husbandry, Jethro Tull, made an experiment which illustrated this matter very admirably. He selected a piece of land six yards wide at one end, and gradually narrowing to a width of six inches at the other. If I recollect right it was thirty feet long. This was spaded to a uniform depth of eight inches. He then planted along the center of the piece, lengthwise, a row of turnips, eight inches apart. Beginning at the narrow end, you see that every successive turnip had a wider space on either side of it, through which its roots might be diffused, than the one preceding it. When the crop was gathered, he weighed each turnip in succession, beginning at the narrowest end, until he came to the point where the space on each side was two feet wide, and there the turnip was larger than any that preceded it. And I may remark, that the weight of the turnip precisely indicated the increasing amount on either side of pulverized land. The proportion of space had a direct relation to the weight of the turnip, until he came to two feet. Beyond the two feet the turnips were of the same size, and did

not vary at all. He tried the same experiment with a variety of cultivated crops, and the conclusion which he drew from the result was, that the normal extent of the root was measured by the amount of pulverized soil which it required. Of course, that amount varied very considerably in different crops. He never tried the experiment with indian corn, but I have myself measured the roots of indian corn, in places where the capacity of the soil was such as to allow the fine roots to permeate the soil to the extent of twelve feet, and I have been informed by reliable experimenters, in whose word I would place as much confidence as I should in my own observation, that they have traced the roots of corn to the length of eighteen feet. I have myself traced an onion root down fully two feet into the ground. I think people generally very much misapprehend the length to which the roots of plants are capable of penetrating, when the circumstances are favorable to their growth.

Now, if this is the habit of the plant, as I am very sure it is the habit of the corn crop, it is very evident that the amount of soluble food within reach is increased by every inch of length you give to the corn roots. Therefore it follows, as a matter of course, that the more you pulverize the soil, the more you enable the roots to spread out, the greater is the amount of food which it is possible for the crop to take up. Therefore, this is a confirmation of the general law which I stated, that the growth of the plant is directly proportional to the depth to which the soil is pulverized.

I was speaking to-day of some experiments with plowing which were conducted at Utica. There was one piece of land, which was afterwards sown with oats, which was plowed to the depth of twelve inches. I requested Mr. Butterfield, on whose farm it was, to pay special attention to the growth of the crops on the lands plowed at different depths, which he faithfully did. The result was, that on the land where the soil had been plowed to the depth of twelve inches—and that, let me remark, was seven inches deeper than it had ever been plowed since Christopher Columbus discovered America—he found there was an addition of eight bushels to the crop, and

an addition of seven pounds to the weight of each bushel, as compared with the crop on the land which had been plowed eight inches deep. This, I think—although the crop was not indian corn—illustrates a principle which will guide us in our judgments in regard to indian corn.

Now, sir, permit me to make a few remarks by way of commentary on the very able papers upon corn which we have heard this evening. I concur almost entirely with the statements that have been made here, but there are certain things which I think ought to be stated with more care than has been given to them. I regretted especially to hear one gentleman state that corn should be planted invariably a certain distance apart. The fact is, that that depends entirely upon the kind of corn that is planted. One of the speakers has referred to Jesse Buell's Dutton corn. I think there are two essentially different kinds of corn which are known among farmers as Dutton corn; one is small and the other large. I was well acquainted with Jesse Buell's farm, but I never saw there any corn with fifteen or sixteen rows. If this gentleman had not stated that he received his seed from him, I should have said that his corn measured not over eight inches in length, and never exceeded eight or ten rows. Jesse Buell originally obtained that corn from Canada; it is small Canada corn; but he pursued one regular rule, to the value of which I can bear testimony. I have myself derived great benefit from it, and I would cordially commend it to the attention of the farmers of Connecticut. Judge Buell commenced by planting only the center of each of the ears. He invariably broke off a portion at the heel of the cob and a portion at the point, leaving none but the very best part of the ear. He was accustomed to go through his field, when the corn approached ripeness, and observe those ears which were earliest in coming to maturity, and observe also those which bore two ears upon a stalk, and around those he put a bit of red yarn. Those ears were selected for seed corn. He broke off the small kernels at the end and the irregularly formed kernels at the butt, and planted none but the middle. The result was, that Judge Buell's corn almost invariably bore two or

three ears on the stalk, and some of it as many as four. The largest crop of corn ever grown in the state of New York was this Dutton corn, and it was planted two feet and a half either way. Now, that would be utterly destructive to large corn, the hills of which ought to be at least three feet apart. This Dutton corn receives just as much air and sunlight, if planted two and a half feet apart, as the larger kinds receive when planted three feet apart. I have seen the Ohio dent corn growing in Illinois nine and ten feet in height. There, it is suicidal to plant corn less than four feet apart. The distance that corn should be planted should always have a relation to its height, and a relation to the supply of air and sunlight to every portion of the field. I think if Mr. Day will carefully reflect upon his own experience, he will find that the rule is to plant corn just as far apart as will bear a proper proportion to the height. There is a Chinese tree corn, which grows sometimes to the height of twelve or fourteen feet, and it can never be planted less than six feet apart. The practical rule, in order to obtain the greatest amount of corn from a given amount of land, is to plant with reference to the height. As the height of the stalks diminishes, so it is profitable to bring them closer together; as it increases, so is it profitable to cause them to recede from each other. The rule is, so to plant that every portion of the stalk shall be perfectly bathed with air and sunlight.

Now, with regard to another thing. One gentleman has spoken of soaking corn in copperas. I think there is a much better article than that. I have seen corn that has been soaked in copperas that has been subject to both rust and brand. Copperas does not usually kill the spores of the brand which are sometimes associated with our seed corn; but if it is soaked a little while in sulphate of copper, you may be assured that every single particle of the spores of brand will be destroyed upon it. You will not have any black corn, if you will resort to this. I am sure you will find the sulphate of copper very much more useful and valuable than copperas.

Allusion was made this afternoon to the protection of corn

from crows. The most successful mode of doing this that I have ever met with is to put a quantity of tar into boiling water, stir it up well until the tar is dissolved, and then pour it over the corn. Then let the liquor run through a sieve, and cover the corn with plaster, which prevents the stickiness of it, so that it will run freely through the hand. I do not know that there is any special manurial value in the plaster applied in this way; the object is simply to prevent the corn from sticking. I have seen occasionally some hills plucked up, but I have never known any general devastation from crows when this tar water was used. I think you will find it a valuable protection against these very destructive birds.

Allusion has been made to the difference between sweet corn and southern corn, (Maryland corn, I think,) as food for cattle. I may state that the farmers of Herkimer county have settled that thing satisfactorily. By repeated experiments, they have found that Stowell's sweet corn will cause their cows to yield a much greater amount of milk and cheese—I think it is nearly thirty per cent. more—than the southern corn. I am not speaking of dried corn, after the ears have been taken off, but of what is generally called sowed corn. Herkimer county is the county where the greatest amount of cheese is made, where there is the greatest number of intelligent farmers, and where the utmost pains are taken to make reliable experiments, and that is a settled question there.

Another thing occurs to me. I have read Dr. Loring's statements on this subject, and disagree with him altogether; and yet I think that the doctor has been visited with an amount of anathema from farmers in regard to his heresies, which is rather undeserved. The fault is in his broad, sweeping, and undiscriminating statements. There is no doubt that, sow corn as you will, there is a great deal of nutriment in it, as every dairyman who has tried the experiment must admit. It is, therefore, perfectly useless for Dr. Loring to say that it has no value whatever. But it is notoriously true, that where corn is sowed so very thickly that no air or sunlight can get to it, where, in a word, the stalk is bleached white,

instead of being green, you lose a very large portion of nutritious matter which you would otherwise obtain from it.

I will remark here, that we are becoming too careless about growing corn. I have seen farmers who were careful in the selection of their seed, who, every year of their lives, were getting a little more from an acre. By paying strict attention to this—and I know no better way than to do as Judge Buell did—a farmer may increase his eight-rowed corn to ten, in a few years. I have seen eight-rowed corn converted into sixteen by this process. And selection is very important in reference to size and quality. I do not know of any practical limit. If a farmer begins when he is a young man and continues during the whole period of his life, I think he would be astonished at the amount of improvement he had made. Certainly, the improvement which I have seen careful farmers produce in this direction is fully equal to the improvement in cattle which has been made by careful and attentive selection of animals from which to breed. *Breed from the best*, is the principle which lies at the foundation of all successful farming. If you are going to breed animals, breed from the best; if you are going to breed seeds, breed from the best, and it will surely pay, in the most extraordinary manner.

The importance of the corn crop, gentlemen, cannot be overrated. The amount of corn raised in the United States, in 1869, was a thousand million of bushels. Just think of that! Conceive, if you can, what an enormous heap a million of bushels will be, and then multiply that by a thousand. There is hardly a man in the whole community who has the imagination to conceive of the vast amount of this crop. It is enormous. My impression is, that the average price throughout the United States was fifty-five cents a bushel. That would be $550,000,000 as the value of your crop. We talk a great deal about our national debt. Well, less than four years of our corn crop would wipe it out. Now, suppose that by any care of ours, by increasing our depth of plowing, by paying more attention to the selection of seed, by adapting our manures more closely to the wants of the corn crop, we should raise two bushels of corn where we now raise one—

and I do not believe there is a farmer in Connecticut who is incapable of doubling his crop—and suppose the same thing should be done all over the United States, what a mighty impetus would be given to the manufactures and mechanical industries of New England! If five hundred millions were added to the income of the farmers of the country by the increase of the corn crop, they would want more new stoves, more new implements, more new coats, more new shirts, more new stockings, more new everything. The whole community would feel this wonderful increase. We should pay our clergymen better, and we should get vastly better preaching. We should pay our musicians better, and get vastly better music. Every thing would respond in the most magic manner to this increase of the corn crop. Now, if these vast moral and physical results will follow from this increase of our crops, is it not worth while for us to make a little effort? Is it not worth while for us to try to stir up our sluggish brains to higher aims and nobler aspirations? If we shall do this, if we shall only *commence* it to-night, the labor and expense of these meetings will be most abundantly paid. (Applause.)

DR. BALDWIN. You said that in Mr. Tull's experiment, the maximum size of the turnip was where there were two feet of loose earth on each side, and the depth eight inches. Are we to understand that if the soil had been loosened to a depth of two feet, instead of eight inches, giving the same area downwards that it had sideways, that he could have got a turnip as large there as where it was two feet wide?

MR. GOULD. That is an important question. Mr. Tull found that the length of lateral range was diminished just in proportion to the depth. He found that the root naturally, spontaneously, if it got a chance, would always go downward; that the deeper the earth was loosened, the less was the lateral spread.

DR. BALDWIN. We have a turnip called the rock turnip, which grows down, and the rutabaga, which grows up. Would the gentleman say that the rutabaga would naturally grow down into the ground, if the soil was loose?

MR. GOULD. Yes, sir. My impression is, (I am not sure,)

that the rutabaga was the one he tried, and he found that when the soil was loosened below, the roots would tend downward, and the lateral spread was diminished.

DR. BALDWIN. He made it grow very unnaturally, if that was the case.

MR. GOULD. Did you ever examine the roots two or three feet down in good soil?

DR. BALDWIN. We find the rutabaga comes out of the ground easily, whereas the rock turnip is hard to pull up.

MR. GOULD. Is not this the difference: that the rock turnip is much larger and heavier than the rutabaga, and the fine roots of the rutabaga are so much smaller that they cannot descend deep into the earth, while the rock turnip has a long, heavy root, which has the power of forcing itself downward.

DR. BALDWIN. There is a natural way in which they grow, and there is a different natural love or disposition for the soil in each. Are not light and air essential conditions for the best vegetable growth?

MR. GOULD. Unquestionably so, sir.

DR. BALDWIN. In pursuit of food, and also of these requisites, air and light, would it not be reasonable to suppose that the growth of the rootlets would be lateral rather than downward?

MR. GOULD. I do not like to go into these long discussions, but I cannot answer the question without a little circumlocution. The functions of the root and the functions of the branch and leaf are essentially different. The roots are the purveyors for the nutriment of the plant; the leaves are the stomachs of the plant, by virtue of which it is elaborated. Take the case of a tree. The spongioles of the root suck up the moisture in the soil, laden with all those manurial matters which the soil holds in solution. It passes upward on the exterior part of the tree, and goes on to the upper surface of the leaf. There it combines with the sunlight, and there its qualities are changed, by combination with the sunlight, so that when it passes from the upper side of the leaf and goes on to the under side, its qualities are entirely different. It then passes downward, and deposits itself in the form of albumen,

or, as it is commonly called, sap-wood, on the outside of the tree. Now, then, this light is made to reappear, when you take a stick and put it upon the fire. If there is no light in the room, that fire will throw out a light, and that light which is thrown out by the burning stick is simply the sun's rays which were absorbed by the upper surface of the leaf and con fined in the sap. The simple elaboration of the sun's rays is fire light. There is, therefore, an essential difference between the function of the root and the function of the leaf.

MR. HART. I do not wish to have the impression go out that I am not in favor of deep and thorough culture, for I am; but when the practical results have been as I have said, the reason I have supposed to govern the result was something like this: that the manure and vegetable matter contained in the earth were in such condition that the plant did not require this length of root laterally or into the ground to procure the nutriment which it needed to furnish the heavy crops that I said I had raised. I am very glad, however, that my statement has drawn out the exceedingly interesting and instructive remarks from Mr. Gould to which we have listened. I have been very much entertained and instructed, and I presume others have.

MR. LYMAN. While we are on the subject of corn, I will say that three years ago, I tried the experiment of selecting the middle of the ear for seed. Up to that time, my crop had not averaged more than from thirty to thirty-three bushels to the acre. The result was, that I had that year, 1869—which we all know was a good corn year—forty-seven and a half bushels to the acre. The next year I pursued the same course, and I had fifty-six and one half bushels to the acre. Thus you see, gentlemen, that by following this course for two years, with the same culture, I had gone up from thirty-three bushels as the maximum, to fifty-six and a half bushels; and I am satisfied, that if I keep on, I shall, with a good season, carry it up to sixty or seventy bushels. This was no fancy crop; there were no extra pains taken with it; it was simply the natural increase, as it seemed to me, from year to year.

S. L. GOODALE, of Saco, Maine. The more I reflect upon

corn, the more profoundly I am impressed with the importance of the crop, and with the prominent place which it holds in American agriculture. I do not know of any other crop with which we could replace it, that would serve the purposes which Indian corn does in our agriculture at the present time; and looking at it as a crop, I believe it fully deserves the en comium which old farmer Taylor of Virginia gave it, many years ago, as being "Meal, Meadow, and Manure;" it furnished bread-stuff for the man, fodder for the beast, and the means of fertilization for his fields. Whatever relates to its culture, to the best method of producing it, and the most profitable method of consuming it, I consider to be worthy of the most careful study of all American farmers.

Adjourned to Wednesday, at 10 o'clock.

SECOND DAY.

The meeting was called to order at 10 o'clock, by Vice President HYDE, who stated that the first business was a lecture by Prof. S. W. JOHNSON, on *Soil Exhaustion and Rotation of Crops.*

LECTURE BY PROF. S. W. JOHNSON.

Mr. Chairman and gentlemen: Sometime since, I received from Mr. Gold a letter asking me to address the Board of Agriculture and the gentlemen assembled on this occasion, on Exhaustion of Soils and Rotation of Crops. In that letter Mr. Gold says:

"We want to go further than the common theory of rotation leads us, and inquire why some crops may be grown for several years in succession, as onions and buckwheat, why corn does not succeed after turnips, why does land become clover-sick.

"Why does the culture of certain crops tend to make the farm richer, while other crops only make it poorer, and in

both cases, the gross amount of minerals and ammonia contained in the crops may be the same, or even greater in the enriching crops.

"Are there certain periods of plant growth which may be called the enriching period, and others, as the fruit season, the exhausting?

"Is not wheat, the prince of cereals, the greatest exhauster of the soil for the product taken from a given area?

"Tobacco should not be a very exhausting crop; yet from the fact, that for the particular purpose for which we cultivate it, a very luxuriant growth is required, do we not need to furnish more plant food than can be assimilated, much of which is lost in the air, and washes away?

"The physical condition of the soil as it is left by different crops is worthy of notice.

"Wheat grows well after peas and clover, also after tobacco; but is not this last owing to the manure left over by the tobacco and the good preparatory culture?

"Corn does not do well after buckwheat, but potatoes do well.

"Perhaps my facts may not be *facts*, but they are believed by a great many farmers, and we want the whole subject overhauled and explained."

After getting here on the ground, and looking over the material which ought to be considered in connection with these questions, Mr. Gold has promised me that I shall have another hour to-morrow, and I will occupy this morning with a part of the subject.

I cannot promise, however, to answer all the questions which Mr. Gold has proposed. Our knowledge is not sufficient for that. Mr. Gold's admission that some of his "facts may not be *facts*," shows that investigation is needed to establish fully what *is*, and to distinguish that from what *appears to be*, before we can reasonably expect to give explanations. But the very investigations which shall serve in any given case to identify the *fact* will also assist in understanding the reason of it, and in seeing clearly its bearings upon the other facts

which we properly regard as settled. I shall endeavor then, as far as the time admits, to put before you some of those considerations which seem adapted to furnish guiding ideas in respect to my subject.

By Exhaustion of Soil is properly understood, not a complete deprivation of producing power, but simply a reduction of this power below a profitable point. This is indeed a somewhat indefinite definition, because the point of profit is not easy to decide upon, but it is sufficient for our purpose.

What does exhaustion consist in? It consists either in the removal of certain materials from the soil, materials which serve to feed the crop and become a part of it, and which, by continually taking off harvest after harvest, become diminished in quantity, so that after a certain time there is not enough left in the soil to produce a fair crop, or else it means that the materials which may still exist in the soil no longer occur in that condition in which the crop can make use of them. We may have a soil containing potash in large quantities, many hundred pounds, or tons even, in an acre, taken to the depth of two or three feet; but if this potash exist there exclusively as an ingredient of some mineral which is acted upon so slowly by the natural process of solution that there is no available potash, as we say, nothing which the crop can get hold of, such a soil would be unproductive. Again, we may have a soil which contains but a thousandth part as much potash, but which is fertile from the simple fact that the alkali occurs there in such a state as to become available as rapidly as the crop requires it.

To cure exhaustion, we must either restore the nutritive matters which have been removed from the soil, or we must change the state of those which still exist there so that they may become available.

Chemical science has established the fact that every crop requires a variety of materials to support it. I have here a number of printed sheets, containing a table of the average quantities of the chief ingredients of our ordinary cultivated crops, of which I would like every gentleman present to have a copy.

Average Quantity of Water, Nitrogen, total Ash and Ash-elements in 1000 *lbs. of fresh or Air-dry Vegetable Matter.*

By Prof. Wolff, of the Agricultural Academy, at Hohenheim.

	Water.	Nitrogen.	Total Ash.	Potash.	Soda.	Magnesia.	Lime.	Phosphoric acid.	Sulphuric acid.
Wheat, grain,	143	20.8	17.1	5.5	0.6	2.2	0.6	8.2	0.4
" straw,	141	3.2	42.6	4.9	1.2	1.1	2.7	2.3	1.2
Rye, grain,	149	17.6	17.3	5.4	0.3	1.9	0.5	8.2	0.4
" straw,	154	2.4	40.7	7.6	1.3	1.3	3.1	1.9	0.8
Oats, grain,	140	19.2	26.4	4.2	1.0	1.8	1.0	5.5	0.4
" straw,	141	4.0	44.0	9.7	2.3	1.8	3.6	1.8	1.5
Barley, grain,	145	15.2	21.8	4.8	0.6	1.8	0.5	7.2	0.5
" straw,	140	4.8	43.9	9.3	2.0	1.1	3.3	1.9	1.6
Indian corn, grain,	136	16.0	12.3	3.3	0.2	1.8	0.3	5·5	0.1
" " stalks and leaves,	140	4.8	41.9	8.9	1.2	2.6	3.8	3.8	2.5
Buckwheat, grain,	141	14.4	9.2	2.1	0.6	1.2	0.3	4.4	0.2
" straw,	160	13.0	51.7	24.1	1.1	1.9	9.5	6.1	2.7
Meadow hay,	144	13.1	66.6	17.1	4.7	3.3	7.7	4.1	3.4
Red Clover hay,	160	21.3	56.5	19.5	0.9	6.9	19.2	5.6	1.7
Timothy grass,	700	5.4	21.0	6.1	0.6	0.8	2.0	2.3	0.8
Maize fodder, green,	862	3.2	8.2	2.9	0.1	1.1	1.2	0.7	0.3
Red Clover, green,	800	5.3	13.4	4.6	0.2	1.6	4.6	1.3	0.4
Potatoes, tubers,	750	3.2	9.4	5.6	0.1	0.4	0.2	1.8	0.6
" tops,	770	4.9	11.8	0.7	0.1	2.7	5.5	0.6	0.6
Turnips, roots,	909	1.8	7.5	3.0	0.8	0.3	0.8	1.0	1.1
" tops,	898	3.0	14.0	3.2	1.0	0.6	4.5	1.3	1.4
Carrots, roots,	860	2.1	8.8	3.2	1.9	0.5	0.9	1.1	0.6
" tops,	808	5.1	26.1	3.7	6.0	1.2	8.6	2.1	1.5
Hops, entire plant,	250		74.0	19.4	2.8	4.3	11.8	9.0	3.8
Hops, the cones,	120		59.8	22.3	1.8	2.1	10.1	9.0	1.6
Tobacco,	180	46.0	197.5	54.1	7.3	20.7	73.1	7.1	7.7
Stable manure,	750	5.8	69.1	6.8	1.5	1.7	6.8	3.2	2.8
Dungheap l quor,	982	1.5	10.7	4.9	1.0	0.4	0.3	0.1	0.7
Fæces, fresh,	772	10.0	29.9	2.5	1.6	3.6	6.2	10.9	0.8
Urine, human, fresh,	953	6.0	13.5	2.0	4.6	0.2	0.2	1.7	0.1
Night soil, fæces & urine, fresh,	935	7.0	14.0	2.1	3.8	0.6	0.9	2.6	0.4
Bone dust,	50	40	608			7	313	257	
Nitrate soda,	20	150	980		336	1	1		11
Sulphate ammonia,	50	200	950						550
Fish guano,	76	78	219				76	72	
Ground kelp,	98	12	211	22	44	12	11	3	68

To give an illustration with one of the substances which is absolutely essential for vegetable growth, I will take sulphuric acid, the proportions of which in 1000 lbs. of our ordinary crops are given in the last column of this table. Sulphuric acid, in the form of some sulphate, must be present in the soil. If we should remove all the sulphates from a given soil, it would be totally impossible to grow any crop or any plant there unless the sulphates were replaced. That is one of the first principles of agricultural science, which applies equally to all of the ingredients stated in the table, with the possible

exception of soda, as has been established by such an amount of experimental evidence, that there can remain no doubt of it whatever. Sulphuric acid, or the sulphates, as they are found in nature, are very liable to be removed from the soil. The sulphate of lime is the form in which sulphuric acid chiefly occurs in land. This dissolves in about five hundred times its weight of water; and where the soil is so situated that heavy rains fall upon it, leach through and go out of it again, the sulphuric acid is rapidly washed away. Almost everywhere, except in the poorest soil, you find the water a little hard, when you use it with soap. This hardness is due to the presence of lime, and in most cases you find the water contains a little sulphate of lime, which is the same as plaster of Paris. This continually dissolves from the soil and passes into the springs and rivers. If the soil is not porous, but of such a nature that it can hold the rain which falls upon it to a large extent, the case is different, and the loss is not so rapid as from soil where the water runs freely through; but we have in this way a constant loss of sulphuric acid from the soil.

Unless there is an unfailing supply of sulphates in the soil itself, furnished, for example, by the chemical alteration of some other sulphur compound, as iron pyrites, there will in time come to be a deficiency of sulphuric acid from this washing process alone, and although this element of crops is the least prominent of them all in respect to quantity it is likely to be soonest exhausted. The moment when the available sulphates in the soil become less than is required for a full crop, it will be impossible to realize such a crop without making good the deficiency.

The soil in a given case may be unfertile, may become exhausted, simply because this one ingredient is removed by the processes of washing and cropping. Lime and soda are also washed out from the land, slowly to be sure, but continually, and in quantities whose aggregate is very large. There are other elements, like phosphoric acid, which we do not lose by washing to any appreciable amount. You do not commonly find this substance in the water of wells or springs, except in

the minutest quantities. It is very rare to detect it in waters, except those which have passed through a very heavily manured soil, or unless it is otherwise especially abundant. Potash, for another example, rarely wastes from the soil, unless it is from light, coarse, sandy land, having but little fine material in its tilth.

If the substances which feed the crop, one or all, have become reduced in quantity or are not in proper condition as to solubility, we may remedy the exhaustion either by applying the materials in the form of some fertilizer which contains them, or we may omit that, and rely upon those processes by which the original rocks of the earth's surface have been converted into nutritive soil; the processes by which those substances, once totally unavailable for crops, have been made available. We can wait the operation of the natural agencies which are involved in what we call "weathering;" the action of water, and of the carbonic acid and oxygen in the air. When we leave land in fallow—a thing which is practiced much less now than formerly—these processes go on in the soil, and prepare a quantity of plant-food for the crop of another year. This "weathering" process is in constant progress and is of great importance in supplying the materials which our crops demand. If that process should be suspended, farming would become a very difficult business. That certain fields will produce crops of the same kind for years and years without any fertilizing addition whatever, is due to the fact, that as fast as the crop requires and removes the materials given in our table they are supplied by the soil itself; they exist in the soil, were originally stored up there, and they are made soluble day by day, as the crop may need. The rate at which this weathering process goes on determines, other things being equal, the natural yield in a given case. By active tillage, throwing up the soil, so that it is exposed more fully to the air, and by drainage, if this be necessary to ensure access of the atmosphere, this process can be hastened. Most saline fertilizers, such as common salt, nitrate of soda, superphosphate of lime, and plaster of Paris, also act in a similar way to dissolve the elements of the soil, and thus pre-

pare them for the crop; so that, although these fertilizers may in some cases do nothing towards feeding the crop directly, they help to feed it by this indirect action in dissolving and bringing into an active form the materials which the soil contains in abundant quantity but in an inert state.

To go back and review, in a couple of statements: Exhaustion is the reduction of the producing capacity of the soil below the point of profitable cultivation, and depends either upon the absolute removal of certain materials, or their removal to such a point that the supply is below the demand of the crop, and such removal of materials must be compensated either by suitable fertilizing applications or by making the unavailable materials still present in the soil available by fallow, tillage, &c.

Mr. Lawes, of England, a gentleman who has devoted a great deal of attention to agriculture, and spent a great deal of money in its study, and who has arranged the most beautiful and elaborate field experiments that have ever been made in any country, has brought out in a recent publication the distinction between the "natural strength" of the soil and what he designates its "condition;" and as this distinction is an extremely important one, I will devote a few moments to its consideration. The natural strength of a soil is its feeding power and adaptedness to crops in all those respects which belong to the soil by its original nature. This standard fertility or productive power is something characteristic of the soil, something you cannot separate from it, something belonging to its entire mass and dependent upon its original composition, texture, and properties. It is a thing which lasts a long time, and perhaps has scarcely any limit in the matter of duration, whatever may be its limit in the quantity of crop which the soil will produce. Every soil has its natural strength, greater or less, the degrees covering a very wide range. You have all heard of soils which are remarkable for their productiveness, or for their want of productiveness. The valley of the Nile, for instance, is a region which has been cultivated for a period longer than history can define with any accuracy, and produces large crops annually of the most ex-

hausting kinds. Wheat and similar grains are grown there continuously, year after year, without any attention, except digging in the seed, watering, and taking the crop off. We find in Hungary and Southern Russia large tracts of country where, every other year, or every third year, large wheat crops are harvested. The land is cleared, the seed put in, and after the crop is gathered the land is allowed to rest one or two years, then another crop is put in, and so on. This process has been going on for centuries. Black Sea wheat is famous all over the world. The export of wheat from those southern districts is immense. Until our western country came into bearing, that was the chief source of the wheat-supply to continental Europe.

We have in our Genesee region, in central New York, a country where the soil is of remarkable natural fertility, and, after the first few years of cultivation, the farmers fell into a routine which enables them to take off wheat crops every third year, right along, with great uniformity. The uniformity is great, at least so far as it depends upon the feeding power of the soil. Accidents, like the rust, the midge, or something of that sort may come in and destroy their crops occasionally, but the feeding power of those soils remains, as a certain quantity, and will probably so continue for a great length of time.

The most interesting case which I can bring up in illustration of the natural strength of soil is furnished by the English gentleman to whom I have referred, Mr. Lawes. In April, 1870, he wrote, in respect to a field on his estate, a paragraph as follows:

"The same heavy loam, of no extraordinary fertility, has yielded an average annual produce, without any manure at all, of 16 bushels of wheat for twenty-six years; 20 bushels of barley for eighteen years, and nearly 24 hundred weight (long hundred weight) of hay for fourteen years."

Mr. Lawes began, in 1844, to see what would be the effect of putting a given plot of land into the same crop year after year, with no manure whatever; and the result is what I have just stated. These averages which he gives are, with one or

two exceptions, the regular yield, within two or three bushels, of this piece of land. A field, for example, which had been, this last summer, twenty-eight years in continuous cultivation under wheat, has averaged about 16 bushels; on one occasion, it went up to 23, and on one occasion it dropped down to five. These variations were due to the season, but otherwise the yield ranged between 12 to 17 bushels, so that this productive power of 16 bushels may be considered as the capacity of that soil in respect to the wheat crop. I do not see any reason why he and his successors should not go on for a hundred years and get the same amount of wheat, within about the same limits. Perhaps it would fall off somewhat. There is a little falling off in the last half of the period just completed. The yield is perhaps a bushel less than during the first half; but that may be accidental, and due to the character of the seasons. There is no reason in my mind why, for the next twenty-five years, the yield should not be a bushel or two more; but we have not lived those other twenty-five years, and we cannot tell positively.

The worst soil we can point out has a certain natural capacity. Take our rocky hill ranges in this State: if we should give a little care to them, we could harvest every twenty-five or thirty years, a certain crop of wood from them; and if we should begin that culture now, and carry it on for a hundred years, we should get the same crop the last thirty years that we did the first thirty. If we carried it on for a thousand years, the climate and circumstances generally, remaining as they are, we could depend upon getting from them three uniform wood crops every century. So in the poorest pasture, we have a certain natural productiveness, which remains the same, so long as the state of the soil is unaltered. The field may become a swamp, or its natural water-supply may be dried up by local changes, but independently of accidents like these, it will manifest a certain nearly uniform natural strength from generation to generation. All production of vegetable matter in the soil, of any kind, is the result of change—the result of chemical and physical change. Natural strength depends upon changes in the soil which act in a nearly invariable

manner for long periods of time. The "Tooth of Time," is an expression belonging indeed to figurative literature, but one also fully justified by fact. It is a tooth whose action never ceases and whose sharpness is never blunted. The grand rock-ridges and peaks which make the mountains of the globe, although they have held their crests aloft in flinty defiance through all the periods of human history or tradition, are slowly wasting under its incessant bite, and the explorer in the high Alps hears from hour to hour the thunder-like noise with which huge blocks of granite, loosened from the moutain-tops, crash downwards. At the base of any high cliff you may see a *talus* of sharp-angled stones reaching half up the breast of rock, unless some rapid stream of water or slow-pushing glacier is there to carry them away. Our level fields are or have been covered with lumps of rock, and our soil is full of them, but these are not sharp-edged as if just struck off by a hammer-blow, but they are rounded in all their outlines; the "Tooth of Time" has not ceased to eat away at every angle and corner of these tempting morsels as the teeth of children gnaw at sugar plums. Nor does the work stop here. As they lie out on the pasture or buried in the plow-land, the same invisible tooth nibbles at every point of their surface, roughening and corroding them until they are reduced to dust. Even the sand-grains are ever cut smaller and finer until they dissolve away from our sense of sight or feel, and the long imprisoned potash and lime, the phosphates and the sulphates, are released.

It is the "Tooth of Time" which thus levels mountains and crushes boulders into soil, and it is the same tooth whose incisive workings in the soil reduce the elements of the rocks to the impalpable state of food for the plant. Where circumstances remain the same, these changes prepare the nutriment for plants at a certain regular rate, and the natural strength of the soil is simply the expression of this steady development of plant-food and the corresponding production of vegetable matter.

To turn now to what Mr. Lawes calls the "condition" of the soil. Farmers are in the habit of saying, "This land is

in poor condition"—or, "This is good soil, but it is rather run down; it is in poor condition at present." Or, looking over the fields of a neighbor, who has taken a little extra pains, "This is poor land, but he has got it up into good condition." "Condition," then, is artificial or accumulated strength; a thing we cannot depend upon, except as we can depend upon the continuance of the artifice or temporary causes of which it is a result. "Condition" refers to those elements of fertility which are capable of being turned to account in the growth of crops within a limited time. We may have a "condition," which is the result of natural causes, as is illustrated by the manner in which Indian corn is grown in some parts of South America, on land newly cleared from the forest. You know that in tropical latitudes, the year is usually divided into two seasons—the wet and the dry. During the former, abundant rains fall and vegetation grows with wonderful luxuriance. The other half of the year is comparatively dry, and plant-life is inactive. At the close of the rainy season, the planters chop down the timber, the brush, and everything that grows upon the land where they propose to get a crop. When the fallen vegetation is sufficiently dry, they set it on fire, and everything burns completely except the largest trees. When the fire has gone out, toward the beginning of the next rainy season, they have a field destitute of vegetation and coated with the ashes of the forest. There, with the smallest preparation, they plant their corn in the ashes, dropping it in where they can, and get a magnificent crop. The second year, they put on corn again and get another large crop. The third year they get another crop, and after that, it is cheaper to abandon that field, and to clear another. The first piece grows up to forest, and in six, eight, or ten years, perhaps, they can burn it over again. Here, the fertility of the soil after burning is a "condition" which is produced partly by natural means, the growth of the forest, which brings up matters from below, and partly by artificial means, the felling and burning of the forests, restoring those matters to the surface.

"Natural strength" is something which is comparatively

unaffected by cropping. Where the soil has great natural strength, you cannot permanently exhaust it; you may get it down to a point where production is unremunerative, you may say your land, once good, is "exhausted," but a skillful farmer will take hold of it, and by the use of some judiciously selected fertilizer, and the application of well-directed labor, he will bring up this exhausted soil in a short time, and make a profitable farm of it. It only needs a little "condition" to reëstablish its good name. "Condition" itself, however, is a thing which is easily run through with. You may take a poor, light soil, and make it productive by the application of manure and by careful tillage, but if you stop there, and undertake to work on that capital, you will find that it deteriorates rapidly. You will have to come down to the natural strength, and if that be small, your crops will correspond.

To illustrate further what "condition" means, take the case of those fields of Mr. Lawes, the natural strength of which was measured by a yield of 16 bushels of wheat, or 20 bushels of barley, or 2600 lbs. of hay, through a number of years. He took a portion of that land and put on it annually, fourteen tons of yard manure, to the acre, and during the nineteen years in which he carried on that process simply, he got 36 bushels of wheat per acre, as the average, some years a little more and some years a little less, and one or two years a good deal less than this quantity, on account of some peculiarity in the season. On another field of the same land, where he put four hundred pounds of ammonia-salts—sulphate of ammonia, I believe, mainly—he also raised annually, 36 bushels of grain. On another field, where he applied fourteen tons of stable dung, he got 48 bushels of barley, on the average, for nineteen years. The annual use of stable manure in this quantity, and the annual addition of a certain number of pounds of salts of ammonia, raised the crop of wheat from 16 bushels to 36 bushels, and kept it steadily at that point for nineteen years; so that the difference between 16 and 36 bushels, that is, 20 bushels, was the crop which was produced from that field by the use of fourteen tons of stable manure in one case, and four hundred pounds of salts of am-

monia in another. It was the stable manure and ammonia salts in those quantities which improved the "condition" of the land by the equivalent of 20 bushels of wheat.

We understand, then, that there is a natural quality in the soil which we cannot easily bring below a certain limit; and there is a "condition," an artificial, temporary or adventitious fertility, which we can easily increase and easily exhaust.

There are many circumstances which necessitate or justify a *Rotation of Crops.* I will not attempt to enumerate them all. Differences of soil and climate, the quantity of fertilizers accessible, the demand in the markets, ease of transportation, politicians, when they make fluctuating tariffs, weeds which come to infest the fields, insects even, may make it advisable to alternate our crops. It may not be uninstructive to go back in history and give a sketch of the gradual development of the practice of Rotation.

The earliest husbandry was simply pasturage. When the people of temperate climates found they could not support themselves by killing wild animals and gathering fruits, the natural produce of the country, they began to tame animals and keep herds of cattle, sheep, etc.; and you know that on the vast plains of Asia and South America, this sort of pastoral husbandry is still the only one known. As population became more dense and land more valuable, people crowded each other, and there was not room enough to roam about at will and settle upon pasture wherever it could be found, unless, for a change, the people fell to fighting, and partially killed each other off, thus leaving land enough for the survivors. When civilization began, it became necessary to cultivate forage crops, or, at least, to take some care of the natural meadows. The next step was to assist these natural resources by growing some grain, and people began to break up a little land, and cultivate wheat and the various grain crops; afterwards, attention was given to root crops. It may not be possible now to show how these steps of progress have taken place in any given locality; but this is a general history of the development of husbandry all over the world, wherever it has attained any perfection. Farmers have always carried

on their operations in a very simple way, at first, for many generations. On the continent of Europe, where we have the most authentic accounts, they plowed a small portion of land, and grew some grain upon it—barley, wheat, or rye—putting in the same crop as long as they could make it grow and get back a little more than the seed. They were content with much poorer crops than we regard profitable. They used the same land for several years, until its "condition" was gone, or until it was no longer remunerative, and then they left it and plowed up another piece. The old field would grow up to grass, and after a number of years they would come round to it again and sow it to grain. That was the earliest and simplest plan of conducting farming. In those days, there was but little skill or thought bestowed upon agriculture. The intelligence of the world was mainly given to government, war, and things of that sort. The peasant was a man who knew nothing except to grub the ground, and he did it year after year, generation after generation, as his father had done it before him, with little idea of change or improvement. In the neighborhood of cities, where there was better pay for this kind of work, and more intelligence concentrated upon it, of course it began to be found that a little rotation was a good thing. Where rotation started, we do not know. In some books it is stated that it was invented in England. But if you will read Virgil and Varro, you will find that the Romans were well acquainted with rotation, although Virgil, who was a poet, only mentions it in an incidental way. Leaving the results of modern science out of the account, there is not much in our agricultural practice that you will not find described in Latin books. Those people, who developed a magnificent civilization which they forced upon the unwilling savages of Britain and the north of Europe, who were our ancestors, did a great deal of good work in the way of agriculture, considering the facilities at their command.

After a time, there came into use in Europe a system which was practised there extensively in the ninth century, and is still followed in some parts of the continent. It was known as the three-course system of rotation. For centuries

this system was carried on where the farmer had large pasturage, and little plow-land. The first year, the plow-land was left in fallow, but in the autumn was prepared, by what manure and rough tillage could be given it, for a sowing of winter grain, mostly rye, which occupied the second year. The third year the ground was put in summer grain which completed the shift. Then the farmer began again, with a year of fallow and manure, a year of winter grain, a year of summer grain; and so he went on—three years—three years—three years—indefinitely. I suppose there are districts in Europe that could be pointed out where this practice has prevailed for nearly a thousand years, and it was early imported into this country. It was the subject of legislation in the time of Charlemagne. Some historians think that this monarch decreed the adoption of the three years shift; others think that he merely recommended it, as an improvement on what had been previously the custom among the less advanced peasants, of simply using the plow for a succession of years, without any rest for the land. In the vicinity of cities, where the plowed land increased in proportion to the quantity of pasture, and the supply of dung became inadequate to manure it sufficiently, so that the manure and fallow together could not make two good grain crops, forage plants—grass, clover, or roots—were introduced into the course; and in that way, a great variety of rotations came into use.

In England, there has been practiced, over a considerable part of the country, what is known as "the Norfolk rotation"—a four years shift. You have all read of it, doubtless. The first year, clover and mixed grass seed; the second year, wheat; the third year, turnips or rutabagas; the fourth year barley; and then the same course again, with, perhaps a little variation; perhaps the land was kept two years in clover and grass. In Dorset, Wilts, Essex, Herts, Suffolk, and Cambridge, in England, ten or fifteen years ago, this course was in almost universal use. I speak of this matter to bring up one point. There are certain advantages in rotation which being observed or conceived led to its adoption. But farmers, especially in long-settled countries like England, are apt, having

once accustomed themselves to a routine, to adhere to it long after its advantages cease to exist. This is illustrated by the fact that Norfolk, which gave England the four-course system just described, began more than thirty years ago to amend its own improvements. The command of concentrated and artificial fertilizers which admit of easy application at any point in a rotation, led some of the best farmers there to introduce another grain crop—oats—into the shift, making a five years course, and according to Caird, in his "English Agriculture," "on a large farm where this system has supplanted the four years course the average produce of all the grain crops has increased in ten years between thirty and forty per cent.; the extent of land on this farm in wheat, having during that period annually increased till it has now (1850–51) become one-third greater than it was then."

In Great Britain, Germany, and other European countries, you will find in many localities very complicated systems of rotation. I saw the other day, in a book which I was looking into for some statistics, a long and curious calculation, showing the various materials—lime, potash, phosphoric acid, &c.—taken off and put on a farm, which was divided into ten equal fields, and each of these fields, went through successively with the same ten years' rotation; which was: 1, Summer Fallow, manured. 2, Winter Coleseed. 3, Wheat and Rye. 4, Legumes, manured. 5, Rye. 6, Potatoes. 7, Clover and grass. 8, Clover hay. 9, Pasture till 1st July, then summer fallow. 10, Rye and Wheat, "half manured."

It is a great advantage, in the conduct of a large estate of four or five hundred acres, to have the whole system of cropping made up beforehand, so that the men can tell just what is to be done from year to year. The management of farm labor is simplified by this arrangement. That is one of the reasons why such complicated rotations are adopted.

It should be well borne in mind that while there are circumstances in which rotation is extremely advantageous there are other circumstances under which it is comparatively unimportant. Certain conditions make rotation necessary, and others make it unnecessary. There are two kinds

of agriculture, which have been defined as "extensive" and "intensive." The "extensive" is where land is cheap, and where capital, labor and manure are scarce. There the farmer must go over a great deal of surface, and depend chiefly upon the natural resources of his farm,—getting out of it what he can, "by hook or by crook." "Intensive" agriculture is where the circumstances are such that the farmer uses a comparatively small quantity of land and a large amount of capital, is able to get fertilizers in abundance, and sells his crop quickly and at a good price. He puts a great deal more into the soil and gets a great deal more from it than his "extensive" brother. He works in a more *intense* way. That is, his labor, instead of being spread over two hundred acres, is concentrated on fifty, and he is able to make his fifty acres more profitable than the other farmer can make his two hundred. In "extensive" agriculture we usually have a large quantity of pasture and keep a good many cattle, for we have to depend largely on their manure. We have to sell off a large share of the crops, which remove valuable materials from the soil, and we cannot or do not buy fertilizers to make good the deficiency. In the other case, the farmer can put in as many fertilizers as he chooses to pay for. He is able to buy them, and he finds his profit in using them. In "extensive" agriculture, which is made necessary by circumstances, the farmer must depend largely upon rotation; he must bring it into successful use. As he succeeds or fails to do this he carries on a paying or a losing business. In "intensive" agriculture the farmer is largely independent of this necessity; he can rotate or not, very much as he chooses. Rotation is not indispensable to his success. That is, the advantages that come from rotation are not so great as the other advantages which the farmer has at command by the use of plenty of money, plenty of fertilizers, by his nearness to market, and high prices.

Now, I wish to state some of those principles which should govern us in rotation, so far as this depends on what we may call the chemistry of the crop and the soil. So far as the feeding power of the soil is concerned, the special require-

ments of the crop should determine the rotation. Of course there are other conditions to be taken into account in practice. Winter wheat, for example, cannot follow itself beyond a certain length of time, even if the soil will allow, because the land ordinarily becomes foul with weeds; and it is better to alternate with some crop which will enable us to destroy the weeds by hoeing or which will choke them out directly. There are many conditions which influence rotation that I do not propose to speak of, but I shall confine myself to that part of the subject which is involved in the feeding of the plant. The broadest principle of rotation is to alternate grain crops with forage crops. That is, to follow plants having a short and rapid growth and which produce seed, by plants of a longer period of growth which are not allowed to ripen seed, but are harvested for their large amount of foliage.

Plants, like animals, have different ways of feeding. If you were to undertake to keep a dairy of hyenas you would have to provide a different food from that which you give to cows. If you should choose the giraffe as a domestic animal you would find that its habits of feeding are adapted to very different circumstances from those of your common pastures. The natural food of the giraffe is mainly the buds and twigs of a kind of locust tree that grows in the African wilderness, and the long fore-legs and long neck of the animal are shaped for browsing among the tops of those trees. The different classes of plants have peculiarities in their feeding arrangements which are as marked and striking as these differences in animals.

On comparing together the roots of our ordinary crops, we find that when they grow under similar circumstances there is a great difference in the depth to which they extend, a great difference in the degree in which they branch, and a great difference in the absolute quantity of roots. Unfortunately, we have not enough really satisfactory observations on these points to serve us in any very extended comparison, it being rather troublesome to make accurate observations of the roots of plants when they have once penetrated the soil. A few brief paragraphs in my book "How Crops Grow," em-

brace pretty nearly all we know about this matter of the growth of roots. As to depth, Schubart has made the most satisfactory observations we possess on the roots of several important crops growing in the field. He separated them from the soil by the following expedient: an excavation was made in the field to the depth of six feet, and a stream of water was directed against the vertical wall until it was washed away, so that the roots of the plants growing in it were laid bare. The roots thus exposed in a field of rye, in one of beans, and in a bed of garden peas presented the appearance of a mat or felt of white fibers to a depth of about four feet from the surface of the ground. Roots of winter wheat were observed as deep as seven feet in a light sub-soil, forty-seven days after sowing. The depth of the roots of winter wheat, winter rye, and winter coleseed, as well as of clover, was three to four feet." Schubart further collected and weighed the roots of wheat, rye, and peas, and ascertained their proportion of the entire plant. Hellriegel has also published some observations on the extent of the roots of barley and oats.

We have a few other observations of this sort, but not enough to enable us to determine the comparative quantity and depth of the roots of our cultivated plants with any accuracy. It will not do to draw conclusions as to the length of roots from such observations as these, made, it would appear, in different soils, differently treated and fertilized, because other observations show that the development of the root depends not exclusively upon any impulse which it receives from the plant (that is, the root must not necessarily weigh so much or measure so much), but depends also upon the nature of the soil. Where this is rich the roots tend to remain; they branch and ramify through all the pores of a small bulk of earth. Where this is poor they stretch off and are sparsely distributed through a larger space. Where they find plenty of food they grow and multiply upon it; where nourishment is lacking they seem to go in search of it. All observations must therefore be comparative. We know, however, in a general way, that the development of roots is different in dif-

ferent classes of plants. We know that clover has a much deeper system of roots than our ordinary grains. We know that where the soil is rich at the surface, and where it is adapted naturally, by its mechanical condition, to the growth of wheat, for example, the large proportion of wheat roots are found within a rather narrow space. On the fertile plains surrounding the town of Leipzig, the principal commercial city of Saxony, situated in one of the richest agricultural regions of Germany, I have seen the same kind of plow going back and forth, which you will find pictured in the classical dictionaries as used by the Romans. If you should take a shingle five inches wide and sharpen it to a blunt point, you would have about the shape of the plowshare I refer to.

This wooden instrument, shod with thin iron, did not turn a furrow; it simply made a groove about four inches deep from crest to base, stirring and mixing the soil thoroughly, however, to that extent. This was the only kind of plowing I saw practised on these fields in 1854, and yet splendid crops were harvested from them. The soil was doubtless naturally of excellent texture and allowed a due penetration of the roots. But the fact remains that with such tillage all fertilizing applications must remain near the surface, and this makes evident that the roots of our grains need not go down to any very great depth. If the soil has nourishment and moisture for them, six or eight inches of earth will answer for the support of a crop. A foot will, in a majority of cases where the soil is of good quality, contain the bulk of the roots of the wheat crop. They may go deeper, as Schubart observed, but only because they must descend in order to find food or drink. It has been shown by experiment that roots develope in poor soil in the vicinity of any enriching material; so that we cannot say, because Indian-corn roots have been traced for twenty feet in a sand-bank, that it is the habit of the maize plant to send out roots twenty feet long. The length depends upon the soil rather more than upon the plant.

It is greatly to be desired that our knowledge of the relative development of the roots of our various crops should be completed. The roots are in one sense the most important part

of the plant. We cannot influence a field crop, except through the roots. We do not manure the tops, or operate upon them in any way. All our efforts to promote growth must be directed to the root, and yet we do not know with precision what is the extent and depth of the roots of the wheat plant, for example, as compared with the roots of any other plant. We simply know that some plants have more and longer roots than others; that clover, for instance, is deeper rooted than wheat.

Some important contributions to our knowledge of this subject have been made quite recently, and I have placed upon the blackboard some figures obtained by chemical analysis of the residues of certain crops; i. e., the stubble, and the roots down to the depth of ten inches. At Proskau, in Prussia, there is a Government Agricultural School, and Dr. Weiske, one of the chemists connected with that school, a year ago last summer, measured off certain plots of land, several yards in dimensions, and carefully excavated the soil to the depth of ten inches and with extreme pains dug out all the roots he could get in that depth of soil. These he dried, weighed, and analysed, and these figures show the average of his results, calculated in pounds upon the surface of an acre. Unfortunately, he did not state any thing about the quantity of the crops; but from the fact of their growing at Proskau, where the soil has long been under cultivation, it is to be presumed that these crops were good.

COMPOSITION OF ROOTS AND STUBBLE—lbs. per acre.

	Dry veg. mat.	Nitrogen.	Lime.	Magnesia.	Potash.	Soda.	Sul. acid.	Phos. acid.
Rye, . . .	3400	62	69	14	30	40	12	24
Barley, . .	1515	22	40	5	9	3	5	11
Oats, . . .	2200	25	81	12	24	17	8	28
Wheat. . .	2240	22	72	10	17	11	7	11
Red Clover,	6580	180	246	46	77	19	24	71
Buckwheat,	1680	45	75	7	9	4	6	10
Pea, . . .	2400	53	68	11	11	7	9	14
Lupine, . .	2800	58	76	12	16	3	7	18

The first column gives the amount of vegetable matter which was contained in the roots and stubble. We are not informed

what the height of the stubble was; probably it was rather short, as straw is too valuable in most parts of Prussia to be left on the ground. These figures were obtained to throw light on what happens under the circumstances that prevail in the culture at Proskau. We want a similar work done to throw light on what happens under our circumstances, and this work should be repeated several years, so that we shall arrive at average figures that can be fully depended upon. Referring to the table, you have of rye stubble and roots, 3400 lbs.; of barley, 1515 lbs.; of oats, 2200 lbs.; of wheat, 2240 lbs.; of red clover, 6580 lbs.; of buckwheat, 1630 lbs.; of peas, 2400 lbs.; of lupine, 2800 lbs.

You see at once the bearing of these figures. You see that when you have got your clover hay off the field, there remains, within ten inches of the surface, twice as much vegetable matter as is necessary to go into the next rye crop, and three times as much as is necessary to go into the next wheat crop. That helps to explain why clover is a good preparation for these crops. Look at the column headed "Nitrogen." In rye, we have 62; in wheat, 22; in clover, 180 lbs. Take lime. In rye, 69; in clover, 246; and so on. What I want to show mainly by this table is expressed in the first column of figures —the amount of vegetable matter remaining in the roots.

Here we have another set of figures which refer somewhat in detail to two of our standard crops—Rye and Clover.

	Roots.	Top.	Roots.	Ratio of Root to Top.
	av. length.	weight.	weight.	
Rye, before heading,	6 inches.	50	30	10: 17
" headed,	8 "	106	23	10: 45
" in bloom,	8 "	143	24	10: 59
" ripe,	8 "	258	19	10: 136
Clover, before bud,	18 "	56	35	10: 16
" in bud,	16 "	94	50	10: 19
" in blossom,	14½ "	106	45	10: 23
" ripe,	15 "	147	99	10: 15

In this experiment, due to Heiden, a mass of soil, one foot wide, five feet long, and four feet in depth, was enclosed in boards, then lifted out and the roots removed by careful pick-

ing and washing. The average length of the roots was noted, and the total weight of roots and tops ascertained. This was done, as the table shows, at several different periods of growth.

You see from the second column that the roots of rye at the time of heading had an average length of eight inches, and did not gain anything beyond that. In the clover, at the time of budding, their length was eighteen inches; in bud, sixteen inches. That looks like going back; but you must remember that the roots measured in the one case were not the same roots as those measured in the other, but were from another plot of ground. In blossom, they were fourteen and one-half inches; when ripe, fifteen inches. The grand result is simply this: that wherever rye roots were eight inches, clover roots were twice that length; and this in soils which I suppose were quite similar in character. That is a piece of information of great value.

MR. LYMAN. I have heard old men express the opinion that the principal benefit of clover arose from the large amount of root which is left in the ground, even after it is plowed under. I suppose that to be the fact.

PROF. JOHNSON. Undoubtedly so.

MR. LYMAN. If we grow a plant which has a very small root, of course the vegetable matter to supply the succeeding crop is comparatively small.

PROF. JOHNSON. I have heard old farmers, and young ones too, say that they would give more for that part of the clover crop below ground than for the part above ground. You have here an accurate setting forth of the proportions. Look at the figures which represent the weight of the top and of the roots. You see there is a rapid increase in the amount of top in the rye plant—from fifty up to two hundred and fifty; but you observe that the absolute amount of roots diminishes. Whether that is due to any actual decay of the root, or whether to the fact that each result came from a different plot of ground, or because of different care in extricating the roots from the soil, we have no information. It may be due to the fact that there was less development of root in one place than in another.

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QUESTION. Might it not be owing to an absorption of the root into the top?

PROF. JOHNSON. It may be. I had supposed that old roots would have the greater absolute weight. If these figures are correct, they are interpreted by your suggestion, which is supported by some observations that have been made regarding the mode of growth of the underground organs.

In the next column of figures we have the ratio of root to top. The root is taken as a fixed quantity, ten. In the case of rye we have, in the first place, 10:17; then 10:45, 10:59, 10:136. In the case of clover, 10:16, 10:19, 10:23, and lastly 10:15, which may be an error of observation.

Here you have another capital fact brought out—the greater relative quantity of roots in the ripe clover plant. You have half as much roots as top, in the clover plant, whereas you have almost fourteen times as much top as roots in the ripe rye plant. These plants, then, are very different in the way in which they act upon the soil, and therefore in the way in which they leave the soil. When you reap rye close to the ground you take away one hundred and thirty-six out of one hundred and forty-six pounds, and thus leave very little in the soil. When you cut clover you may leave half as much in the ground as you take off. That is a point of great importance in considering their relative bearing upon the question of exhaustion, and shows that you may expect a very different result from leaving clover roots and clover stubble in the soil than from the roots and stubble of rye.

MR. LYMAN. If we cut the rye low we take very nearly the whole of the plant off from the land, and it requires five times as much put back to bring the rye field up to an equality with the clover field, as it stands cut, with the roots in the ground. Therefore we cannot look for a crop that would be equal to what clover would bring us unless we restore this ratio.

PROF. JOHNSON. You are right.

MR. LYMAN. What is the difference if we plow the two crops under?

PROF. JOHNSON. The total weight of your rye crop is 272;

the total weight of clover is 246; so that in this case the clover has a somewhat less absolute mass of vegetable matter.

QUESTION. There are two or three other important questions. We want to know if the plants take from the soil a certain amount of manurial constituents or saline matter?

PROF. JOHNSON. They do, of course. That is one of the first principles of agriculture.

QUESTION. Do these roots left in the soil create any thing?

PROF. JOHNSON. Nothing whatever.

QUESTION. Then they take from the soil manures to grow them, the same as what you take off?

PROF. JOHNSON. Certainly. They take manures or equivalent nutritive matters.

QUESTION. It took all these manurial matters to make this crop, and if you carry it off you carry off those manurial matters; whatever you leave restores what it took to make it, and no more?

PROF. JOHNSON. Yes.

MR. GOULD. Ought it not to be said that in its previous condition the manurial matter was in an insoluble condition, not adapted to the plant; whereas, what you leave is in a soluble condition, and assimilable?

PROF. JOHNSON. During the growth of a crop, plant-food in the soil does pass from an insoluble into a soluble form, and being taken up by the crop remains in that part of the crop left in the field in a state adapted for immediate use. The deep-rooted clover also, in this case, brings up, from an average depth of sixteen inches, matter which remains in part within the range of shorter-rooted grain crops.

Adjourned to two o'clock.

Afternoon Session.

Wheat and Rye.

The afternoon session was opened by a paper on the culture of rye, by James B. Olcott, of Buckland, which was read by Mr. Gold.

CULTURE OF RYE.

JAMES B. OLCOTT.

The old saying was that "any land that'll grow big mulleins will fetch a good crop of rye." This came to be used after our plain-lands had been stripped of their wood to supply glass works now almost forgotten, and when well-worn sandy fields were already common. The plow for rye was driven at its liveliest speed, perhaps, in our town, a full generation since, before the increase of manufactures, while every farm-house was packed with full-fledged children, like a nest of grass-quails just ready to take wing; while our uncles and aunts were being pinched off westward by the sterility of the land, or while the dull boy of the family was making desperate efforts to portion the bright ones off for college and keep the old homestead intact by growing this grain at fifty cents per bushel to the distiller. A proper credit where credit is due, would mete to the "dull boys" of those times, who fed the fires of the family altar while their more mercurial brothers and sisters went errant over the world, with a fuller measure of honor than has been customary. Their attention to little things and small savings, imperative in their circumstances, has incurred the contempt of the superficial and thoughtless observer. Yet a just consideration of the self-denial and the long lives of patient, cheerful, lowly labor of many a close-calculating rye-grower of the past generation will show that he helped mightily to make solid the foundations of our national wealth, and instead of being stingy and

mean, has really borne himself towards what seemed his nearest duty, with a faithfulness truly heroic. The oak and the rose are alike dependent upon the broad base of roots that continually and contentedly draw sustenance from the soil; and the florid and umbrageous superstructures of our modern society found the germs of their growth in the elaborated sap of the earth, gathered in driblets and savings by many a so-called "skin-flint" rye-grower.

A spurt of well-doing for the hour has its reward in the hour's applause, but the fight with the unending difficulty of shaping gracefully and graciously the ends of a life upon a sterile New England farm, during the major part of the past seventy-five years, was of the long-winded sort of human efforts and struggles that will never cease to give inspiring themes to the true poet. For the fact is, we gave our smartest boys and girls to the fat lands of the west, and for years have been competing with them in grain-growing with such disadvantages. Our prices, from fields faint with exhaustion, have been struck level as our railways, with the produce of a virgin soil. Looking for the bottom cause of things, it is clear that but for our rye bread—but for the peculiar virtue, as bone, and brain, and muscle-producing food of the staunchest sort, resident in the brown skin of our rye kernels—we could not have held our own in the unequal struggle!

The production of this grain in our town at present, (Manchester,) is not large, as may be understood when I mention that we have no public grist mill within its borders, and but a single run of provender stones in private hands. Our eyes are fixed upon the manufacture of other things than flour, meal and feed. We buy our breadstuffs, or make occasional trips to other and less sophisticated towns, with our single bag of rye, or corn, or buckwheat. It is scarcely worth while for me to do more than respectfully refer to the questions of Mr. Secretary with regard to our present methods of cultivation, acreage and maximum, and average production. We sow rye enough so that children who walk two miles to school still know this cereal by sight. We raise, in town, perhaps nearly as much as we use for bread, for we have come to use

but little of it, and that little is consumed chiefly by our most conservative and old-fashioned people. Yet there seems to be a revival of interest in this grain as human food. The prejudice against its honest drab color is being somewhat abated. Obscure diseases of the nervous system are quite prevalent, and it comes to be remembered that in the times when bread was browner and rye was a staple raw material for it, that very few people were aware they had any nerves. I've seen a "nervous sufferer" of our town, "worth a hundred thousand dollars," so disgusted with medicine, and fearful of "refined," medicated, stale and musty breadstuffs, as to fling them all aside and fall back upon the simple brown rye in the berry, which he grinds in his own coffee-mill and cooks in his own porridge-pot, to the rapid building up and rejuvenation of his physical powers. And it is this altogether human view of the rye interest which inclines me to select it for the subject of this communication. Not because we produce much of it or use much, but because there is a growing belief among shrewd people that we ought to do both a deal more than we do. That we ought to grow it ourselves just for the sake of having it clean and sweet, and close at hand. Wheat suffers badly in coming to our market, through vermin and musty sweats in stacks and elevators. It is high time we began to raise our own. We could do it as cheaply as we can buy it, except that we are somewhat out of that line of business and have forgotten how. But the readiest way for us to strengthen the wheat crop is to vary our "staff of life" by using bread from rye occasionally—a grain that we still have the seed of, and which, like the people who live upon it, is the hardiest of its species, defying insects, sterility and climatic rigors. The appetizing difference between wheat and rye is a continual source of gastronomic satisfaction of precisely that sort necessary to health—well understood by the lover of both grains, who delights to turn from bread of one kind to bread of the other cereal at frequent intervals through the year. I hear of inexperienced hands getting embarrassingly stuck in the gluten of rye during their first experiments. To beginners in making fine rye bread, I can commend with

confidence an admixture of twenty-five per cent. of wheat meal or bran. For that vulgar despite of the natural color of rye which we find, sometimes, in kitchen help and sometimes in kitchen mistresses, I know of no remedy but a radical change of heart, being brought, by greater access of knowledge, to estimate values, not according to appearances, but according to intrinsic worth. No chemical analysis that I have seen accounts fully for that peculiar relish, craving, hunger, requiring for its satisfaction a change of bread, so often experienced by hard-working adults. People who have been sufficiently well-bred—or well-breaded—have a store of the different breadstuffs in the house, and with two or three kinds constantly upon the table, or baking now from their stock of wheat or rye—coarse and fine—or corn, barley or oats, have no necessity for philosophizing in the matter, being so variously supplied as never to feel the hankerings from which their less provident and thoughtful neighbors ignorantly suffer. The people most likely to injure themselves unwittingly by abstaining from rye are those who owe their solid muscles, firm nerves and strength of stomach to having used it, or the other kindred cooling grains—oats and barley—in their youth; or through being descended from parents fed upon them. Such people are apt to turn to the finest wheat bread as nicer and more delicate and palatable—as by the fruit of their exertions and the abundance of the land, they come into easy circumstances—looking back upon coarse or brown bread as not a whit more necessary or useful than coarse clothing. The young Russian who has recently been visiting us, might travel across these States again and again without seeing any but the merest starchy wheat bread—divested of the vital parts of the grain—the brain, bone and muscle-supporting phosphates. Perhaps he did that, and so suffered from constipation and indigestion—unless in bread, as in bedsteads, he had sensible notions of his own that led him to reject the "fuss and feathers" that were prepared for him, and order brown biscuits from his own ship as he ordered up his simple hammock. If the home diet of this vigorous young man were made public, I'll warrant it would be found

that he got the full proportion of bran to his bread and butter; for however independent or even reckless a republican citizen may be in the matter of diet, it stands your royal family in hand to nurture the supply of muscles of the lustiest peasantry, or their royalty would soon come to an end.

That there is a fine, lively spirit in rye is an old idea that our forefathers were too full of, and the quack medicine venders have not forgotten. It remains for this generation to prove that this spirit is best, every way, when extracted by the natural processes of digestion. It is not necessary to stimulate the growth of this grain because of any real scarcity. How many thousand bushels of it we are worse than wasting, the distillers know very well. And this sin of misuse is one of those which has been well designated as unpardonable. Its punishment has no atonement, cannot be avoided, and will mainly assist in bringing us to repentance. There are not, I hope, many old women left in the land now, who will confess that they could "never bear rye as bread, but who can manage to worry down a little of it when made into whiskey."

That was a proud day when I was first set to plow for rye. The "system" pursued on my father's farm in my boyhood is not altogether in disuse yet, and may be worth describing. It might fairly be called a "four-course system." There were four old fields, of from sixteen to twenty-five acres each—all of which were liable to be seeded with pines, birches, or moss—and one of which was plowed annually, in rotation, for rye. The others afforded sparse forage for a hundred sheep, or so. Such a thing as applying manure to the land, or grass-seed, was no more thought of than of scattering such things upon the mill-pond in winter. Of course fertility was at a low ebb, except under the shade of the great oaks that attested the former strength of the soil, and upon the knolls where the sheep left their droppings. The game was to take from the land the cream that had risen, so to speak, in four years' rest, and set it for cream again. Rye was the handiest and surest skimmer to do it with. I never heard of harm coming to a crop of rye upon our sandy old fields where the subsoil is porous, but twice in sixty years. Once our rye was

badly cut by hail and once by frost while it was just in bloom. It used to be a saying that rye looked well when it headed out before "lection." The springs were warmer, perhaps, and more moist then; and the rye lot was oftener under the lee of woodland than now. At any rate, we rarely see it come up like that in honor of the election parade of these days.

My first day's plowing was in the field of twenty-five acres. The lands were long and but two rods wide. Nothing was said about the furrows being straight or the headings square; such matters were of no account. It was in early July, a lowery day, so early in the season that my father, I think, must have considered the possibility that my ten year old enthusiasm would carry me through the whole field, so as to give time to cross-plow with advantage before sowing. At any rate, he started me with the plow at what used to be called "cut and kiver." That was—perhaps the boys may not know—to run the plow wider than it could possibly turn the furrow, and so lap the furrow-slice upon a strip of equal breadth that was unturned, to smother and deaden whatever of grass, or seed, or moss, or life-ever-lasting, or rattle-boxes there was growing. It is not so bad a plan as it seems, when nicely done, and followed in due time with another plowing and harrowing, for sweeping the pelt from a friable old field. I didn't make very good work of it though. Probably the ox-yoke wasn't long enough, or the clevis might not have been set right. We use very short yokes in our section, with not much more space between the bows than inside the bow-holes, to keep the oxen from staggering in and out of our sandy ruts upon the road. I did not hold to the "cut and cover" plan long, but fell upon such regular plowing as could be wrought with the old "Ben Lyman" plow, without a coulter, in my feeble and inexperienced hands. The stags were kind, hawing about at the ends of the land with a broad sweep, browsing the scanty briars and grass the whiles, and not much minding my cutting away at their tails with the whip. After righting up the plow from its drag upon the land-side, (a ten year-old boy isn't big enough to swing the plow round the ends, you know,) and entering it in the ground firmly, with very likely a

clumsy rounding of the corner of the land every time, I found continual delight in watching the clods roll from the smooth mold-board and pitch over into the furrow—like living things—as I have since seen waves and porpoises do. There seemed a continual chance of stranger things turning than the mere squirm of the sod as it twisted heavily into its place, burying continually the blurred foot-print in the bottom of the preceding furrow, made by the shambling step of the off ox. Sometimes an Indian arrow-head gave small reward to my search. Most farmers, and perhaps a good many others, go through life looking for more than they find. My orders as to depth, were to "run light over the knolls, but let her in beam deep in the hollows," which the "Ben Lyman" plow was well calculated to do without orders. Plowing for rye was rather pleasant work for a boy, but harrowing was dull business, that I had tried before. Hard walking for slim legs upon the crumbling furrows, and dusty withal. The boys of those days were, many of them, harrowed off the land. I had my suspicions that we didn't half finish our work; also, doing it as if we hated it and didn't find it to pay very well. We harrowed once to smash and tumble the sods around a little, with a heavy square harrow, and once more to cover the seed, or hustle it and mix it up with the earth; yet the pigeons and doves got considerable of it whenever the weather was dry. But a kernel of rye is quick to send its root downward and set its purplish green spear aslant in the air, above even the roughest seed-bed. It is very grateful for a little cultivation, and I have seen a very fair "volunteer" or self-sown crop from the scatterings of the harvest.

My chance to go forth as a sower of the good seed of rye, came pretty young too. "Here, boy!" cried my father one morning in the forepart of September. "Let me see you feed the chickens. You've got to learn to sow. I want to set you to sowin' that rye! Get a measure of the tailin's on the barn floor, and bring 'em out here. There—wait, and see me sling a handful. Your fist is smaller than mine, but your steps will be shorter. Hold your measure with your left arm—so—fill your right fist full of grain—set your left foot forward—jerk

your hand out of the measure with a smart flirt to the right, as full as you can grip, so that a little scatters about your feet. Out with your right leg as you let your hand back to gather a swing for the upward stroke, which directly follows, scattering the seed in a semi-circle, high and far abroad. Swing your fist up, boy! don't look at the chickens. You want to set the kernels a-whirlin' ag'in' the sky! then you can tell whether you throw 'em smart, or not. The sower's step—mind—will fetch your right arm back with a jerk, just in time with the spat of your right foot forward; that will keep your balance. Get the sower's step, or you'll stagger, and tumble down, like enough. And in making the cast, which must be done with force—smartly—none of your old-country pottering over a six-foot strip, sifting the grain around between your thumb and finger, at a shilling a day—but sling your hand round as if you were hitting something, so as to make the seed fall like the clip of a mower's scythe, a rod wide. Let out a little leak of seed at the right from your full hand, and open one, two, three fingers in succession to let the grain through, and spread it in front, and hang on to a pinch to carry over to the left. Don't let your arm drop as you swing—you Guinea man! Keep your fist above your chin as long as there is a kernel in it, and swing—swing boy—as if you meant to sling your fist off!" Such were the cheery orders of the former generation as to sowing, and a boy of twelve may get the trick while feeding corn to the chickens across the door-yard. In the field we had our deep dead furrows once in ten paces as guides for our steps, and it required a bout and a half for a boy to seed a land—up and down around the outside of the land, and once along the crest, being careful to lap the scatterings of each cast of seed a little. It is hard work for a youngster to lug a bail-basket or Shaker-pail of grain over plowed ground. It might be done on the back of a steady horse; but an ambitious boy will take the job cheerfully, because it is a man's work. Indeed, there are many men who say they can't sow grain, and many others who undertake it that make but slobbering work. A good deal of skill and practice is required to make a good seedsman not altogether

afraid of a windy day. There are implements that do their work fairly. Cahoon's is a very ingenious contrivance, and answers a good turn upon a still day. But in making a cheap grain crop one can't always wait for the weather. The man who could be trusted with the machine could get along without. There are good horse-power drills that will come in play I hope in the future days of more thorough tillage.

But, meantime, sowing by hand should not become one of the lost arts. It is very convenient for the small farmer to slip out in the gray of the morning and cover his five or six acres with seed before breakfast, while his team is eating, or if the day is hot, he can sow his grain while his animals rest; or if larger undertakings are in hand, a good sower will lay on the seed faster, by hand, than any harrow or bush ought to follow him. We used to sow from three pecks to a bushel per acre, of seed, and we used to call ten bushels of rye to the acre a fair crop on old fields—didn't grumble if we got eight, but seven was "rather slim." Twelve bushels was "first rate," fifteen bushels was "stout," and generally meant newish land or land in better heart that had been summer-fallowed. I've heard of twenty bushels to the acre where land had been manured and prepared for grass, but it was not considered so very profitable, for the straw was too heavy to cut with a cradle, no reaping machine was to be had and reaping by hand was expensive, with old country labor that could spend a day in reaping and binding a quarter of an acre. There has been one well-attested instance in town of a harvest of forty bushels per acre, through the thorough tillage and generous culture of an Irishman and a manufacturer. And a bit of warm, sandy land, within a few rods of my door, cleared of shrub-oaks and pines, very generously dunged, used as an early garden one season, and sowed with rye in August, gave a yield at the rate of something more than forty bushels per acre. I mention these things to show that rye is not so meagre in production as it is popularly supposed to be. The former generation tell big stories of the prowess of some of the muckle harvesters of old times. The elder B— boys used to cut and bind their two acres of rye

per day, with a sickle; and the two brothers O—swept a sixteen acre piece with their cradles in one day. Perhaps they had a jug of rum at each corner of the field—for it was in the times when men who had harvesting to do always "furnished." We certainly can't do such things now. And I look back upon harvests of fifteen years since, when four men and two boys put the crop of that same twenty-five acre field —there were seventeen heavy loads of it, I recollect—in the barn inside of five days, with somewhat of surprise. Two men cut it with cradles at fifty cents per acre, in a little more than two days and a half. It will require the hum of a power reaper to do it as quickly again. As to present profits, I will state that that field has been going begging for a year or two to any responsible party who would take the same upon shares, furnishing seed and labor, 'till the grain is put in shock, and taking two-thirds of the crop for pay. The birches and moss are coming in some, but one pair of oxen could handle a plow there well enough. A more common way is for the owner to furnish half the seed and receive half the crop. The matter with these fields is that though the grain of the soil is right to produce a capital quality of rye, they are about twenty-five dollars per acre too poor to be handled with profit. They are like free horses which yield their strength to any sort of a driver. They are like big mills without machinery, or storehouses without goods, and are simply awaiting the future needs and better cultivation of a growing population. A man who liked to work upon rye, could turn his physical force and a small money capital, into cash, by treating such lands to wood ashes or fish guano that didn't cost too much. Seventy-five bushels of ashes at twenty cents, or half a ton of fish pommace at eighteen dollars per ton, would not make a bad showing with a vigorous worker who owns his land. Probably a catch of clover could be got with such a dressing, which would make more barns, and stock, and labor needed, and at last, pleasant homes, with rugged children growing up on rye bread, with a stomach, bye and bye, for what people consider something better.

As regards threshing. What rye we raise we generally

pound out by hand after the mice have worked through the mow some in winter. Whoever has ability enough to run a threshing machine, gets drafted, sooner or later, into some mechanical employment that gives him work the whole year through, and our sowings are smaller because of competition with richer lands by railway; because our manure and farm labor is expended upon tobacco with what appears greater profit, and because there is not the demand there should be from an intelligent people for choice rye for family bread. With a little awakening of public sentiment as to this latter matter, a little greater home consumption of breadstuffs at the west, a little closer attention to what is really a source of lasting profit to the farm and the community, and we may take a "new departure" in rye-growing, with a more general use of capital, manure and harvesting machinery.

The common threshing machine injures the marketable value of the straw, making it less readily portable. I hear by word of mouth, of a power-thresher in common use about Chatham Four Corners, Columbia county, New York, which preserves the straw as perfectly as if threshed by hand, and wish I could give the maker's name.

The straw upon an acre is often worth more than the grain itself, bringing $25 and $30 per ton to collar-makers and stable-keepers. Its value for manure is not great, and its deportation should not rob the farm of substances that are difficult to obtain. I believe there is authority for supposing that the rye-grower might sell both straw and flour at current prices, retaining the bran and a fair proportion of the price in his business without depleting his land. I heartily wish there were some philosophic Connecticut man with the leisure and means to make exact experiments in this direction, and in other matters, for our State, as Messrs. Lawes & Gilbert have made for England; and with this suggestion, my dear Mr. Secretary, I leave the rye crop in the hands of the honorable Board of Agriculture and yourself.

MR. GOLD. I wish we might have the opinions of the company upon the profits of the culture of these crops here in Connecticut, as well as the methods of their culture.

MR. BLAKESLEE, of Watertown. I commenced farming in 1807. My father deeded me 70 acres, called worth $200. I had no means of support but to improve that land, and I endeavored to enlarge the possession by the product. I took the course of the rotation of crops that has been so ably discussed by Prof. Johnson; and what I expect to do is to give my experience through all this time—sixty-six years. There are very few, probably, in the New England States, who have had that length of experience. This land, you see by the price, was in a very low state of cultivation. I have never purchased any land, during the whole time, at a high price; I have taken all the land that I have purchased at its lowest state of cultivation, and my support has been derived from improving that land by rotation of crops. During this time I have cultivated over five hundred acres.

The first crop which is usually planted is a crop of wheat, which is the foundation of our discussion. That crop of wheat prepares the ground for a crop of herbage. I think that a crop of wheat, which is nourishment for the human race, prepares the ground for herbage for the animal race. The next crop is corn. When plowing for corn I plow so that one furrow shall just lap over to the other, so that the vegetation in decaying shall furnish nourishment for the corn. In that way I soon found out that I could get from thirty to forty and sometimes fifty bushels to the acre. I had no manure and nothing to make manure of. That crop of corn prepared the ground for a crop of flax. That crop of flax, in those days, furnished the material for the clothing of the family in the summer. It furnished twine for our shoe-thread, and the seed was manufactured into oil to preserve the life of our buildings. It was a very important crop, but one which is now almost wholly neglected. That crop of flax was succeeded by rye. That crop of rye prepared the ground for herbage again; not as well as wheat, however, for we were then under the necessity of sowing a little grass seed on the rye, in the spring generally sowing timothy or red clover, which was one of the native grasses and took better than any thing else. That field was mowed one or two seasons,

then pastured one or two, bringing the whole course into six or seven years, because flax cannot be raised on the same ground oftener than once in six years. Then at the end of six or seven years we would go back and go over the same ground again. Where we had land enough, say seven fields on a farm, we could have one of each of these crops every year. I have practised that system more than half of the whole time. Since that time the article of flax has gone out of use here, and I do not cultivate it at all. After following this course three times over, which would bring it from eighteen to twenty-one years, my land was raised more than fifty per cent. in value in product. I had improved it more than fifty per cent. by that course, without any manure.

I agree with the gentlemen who spoke last night on the subject of corn. We can do much better to manure so as to get a very heavy crop where we plow than to undertake to cultivate more ground; but I did not hear one of them give any account about the back part of their farms. Their cultivation was apparently confined to a very small spot. The manure that is taken from the whole farm is probably placed on this small spot of ground. Now I must state to this board that I am in possession of some two hundred and sixty acres of land, and there is not an acre of unproductive ground upon it. There is not an acre of waste land there. I do not suppose this will agree with the common course of culture at the present time.

I will mention that on the farm where I now live, there was a piece of ground of just about an acre, lying on the south and west side of a piece of woods. It was so barren that nothing grew upon it, and the land so sloping that all the soil had been washed off, so there was no herbage there. I bought the farm in 1834. The second or third year afterwards I thought I would do something with that place, and I plowed it and sowed it with rye. I got six bushels of very poor rye from the piece. I put on a little southern clover and let that field lie about four years. Then I plowed it up again and put on about six cart-bodies of barn-yard manure, which had laid some time and its goodness had evapo-

rated so that it was not very strong. I sowed one half of that field with winter wheat and one half with rye. I had nine bushels of rye and fourteen of wheat—as fine wheat as I ever saw. I seeded it with this southern clover and where the wheat was I had a good crop of herbage—English grasses and white and red clover—and not a particle where the rye was; yet it was tilled all alike. That is one of the facts which leads me to say that wheat prepares the ground for the grass crop. That lot then lay about four years more. I then ploughed it up and put on about ten cart-loads of manure, and I had twenty bushels of as fine wheat as I ever saw. That lot lay about another term of four years and I then planted it with corn, and had about sixty bushels, and perhaps carried on twenty loads of manure. Another experiment I shall try, if I live and have my health. I shall plant that lot without a particle of manure, and if I do not get seventy-five bushels of corn I shall be disappointed.

Mr. George Sanger, of Canterbury. I do not feel like occupying much of the time. I would rather hear from others than speak myself; but I felt yesterday, and I have felt to-day, that we have failed to get out the practical experience of different farmers in different localities, which I have no doubt gentlemen here present are very desirous to hear. We have been very much entertained by the essays which have been read on the various subjects, but we would like to know what is the practice in different parts of the State in reference to these different cereals. And so, also, with regard to potatoes; I am desirous that there shall be something more said on that subject. I will only occupy a few moments in regard to the question now before us.

The cultivation of wheat is pretty much out of the question in this part of the State. I have been told by some here present from the western part of the State, that it is a common crop there, but very few, if any, farmers within my knowledge undertake to raise wheat here at the present time. But there are a great many among us who believe that rye is one of our most valuable crops, and it is becoming increasingly so, from the fact of the high price that the straw brings,

which, as has been remarked in the essay, is more valuable than the rye itself, at present prices. These plains upon the Quinnebaug river are particularly adapted to rye, and where the farmers keep flocks of sheep to run upon those plains, they will produce very fair crops once in three years, with very little expenditure of labor and capital. I consider my rye crop as valuable as any I raise. The common rye is the kind that is usually sown. There was a kind introduced called white rye, which seemed to take for a year or two, but it has entirely gone out of use now.

QUESTION. How many bushels to the acre are usually raised?

MR. SANGER. Not far from ten bushels to the acre. I should say that I had a good crop if I got ten bushels to the acre.

QUESTION. Don't you sometimes get a good deal more?

MR. SANGER. Well, I think we do. My father used to sow a field that is owned now by our family, from which he used to get one hundred bushels from eight acres, and he thought that was a fine crop, as it was.

These lands that we sow rye upon are situated so far from our houses that it is difficult to manure them; but sometimes we plant corn or potatoes upon our plains, and manure, and then we sow rye after taking off the crop. In such cases we can realize more from a crop of rye than from potatoes or corn. Rye is always benefited by the cultivation of the ground with a hoed crop. In all this region we have acres of plain land which is nearly worthless. Since sheep have gone out of fashion among our farmers those lands have been running down. Now, I believe that if every farmer who has such lands would have a flock of sheep, adapted to his extent of territory, he would find that the sheep were the surest and cheapest way of improving those lands. I regard my flock of sheep as the most profitable stock I have, and they will live, as is well known, where no other farm stock can get a living. A neighbor of mine has a plain upon the Quinnebaug of some fifty or sixty acres. It is a very barren-looking field, but he will summer sixty or seventy sheep upon that plain, from the last of April until cold weather comes. You

would suppose that there was nothing there for them to eat, but they will go through the summer in good condition. Whenever he turns over that plain for a crop of rye or buckwheat, as he did this past season, he raises good crops. I should say that he shifts his fences round so as to enclose about eight acres in one part of the field one year and in another part another year; and this year he had a field of about eight acres in buckwheat, from which he got about one hundred and thirty bushels. If there had not been any sheep upon that plain he would not have realized anything like that crop of buckwheat. The same will hold good in regard to rye. Whenever he gets ready to turn that plain over, comparatively worthless as it is when you look at it, he will have a crop of rye worth harvesting.

I will say still further that I have some ten or twelve acres that lie upon the river, in one level piece, and my way of harvesting is to attach a reaper to a Clipper mowing machine, and I am not obliged to pay a dollar an acre to have it cut down or have it cradled. I can do it better and quicker and cheaper with a pair of horses and a reaper. Any one who has level land, free from obstructions, will find it to his profit to have a reaper attached to his mowing machine. It can be made applicable not only to rye but to oats.

QUESTION. Do you find it works well in very heavy grain?

MR. SANGER. I don't care how heavy it is; the heavier the better.

QUESTION. Suppose it is lodged?

MR. SANGER. I think it will go through. I have never found any trouble. You will want a dropper attached to the reaper, which drops the grain in bundles. If your rye is heavy, you will want three or four men to follow right on, to keep out of the way of a pair of horses, bind it, and throw it one side. The bundles will be even and like the bundles of reaped rye. They will be in better shape than if cut by a hand cradle and raked with a hand rake.

MR. OLCOTT. What reaper do you use?

MR. SANGER. I use the Clipper reaper and mower, and I ~~am~~ willing to endorse that machine any where. The size is No. 4, I think.

Mr. Wakeman, of Westport. There is a great deal of wheat raised in the town of Westport, and more than there was twenty-five years ago. We do not break up a piece of ground for the purpose of raising wheat entirely, but we have a great deal of meadow land and we always find that grass will take better after wheat, and always sow it either after corn or potatoes. I think for ten or fifteen years past we have got from twenty to twenty-five bushels to the acre, on an average. Forty bushels have been raised to the acre. My brother had two acres this year on which he raised nearly seventy-five bushels. I should think that within a space of six miles square nearly half the breadstuffs we use in that place is raised. There is very little rye raised with us. We should not consider it a very profitable crop if we could not get but ten bushels to the acre. We should want to get from twenty to twenty-five.

Mr. Day. I believe Mr. Wakeman lives in the vicinity of salt water, where there are a great many fish taken. I would enquire if he has ever fertilized with fish pommace, or fish guano or anything of that kind?

Mr. Wakeman. I used fish guano to a considerable extent some years ago, but I did not think much of it. I have also used fish, but do not find its effects very lasting. But in that section of country, six miles square, I suppose there are $50,000 paid for manures every year. Two years ago there were 75,000 bushels of ashes bought, and last year 50,000, besides two or three hundred tons of bone dust. One of my neighbors, who lives within half a mile of me, went around among the farmers, and they engaged over a hundred tons, within a circuit of not more than two miles from my house, besides what other fertilizers they used.*

* Mr. Wakeman gives the following estimate of amount and value of fertilizers used in 1871 in the vicinity of Westport:

60,000 bushels of ashes at 25 cents,	$15,000
5,000 tons of bones at $35,	17,500
120 tons super-phosphate at $50,	6,000
1,000 tons of salt hay at $10,	10,000
5,000 loads of sea-weed at $1,	5,000
	$53,500

QUESTION. Do you put ashes on the crop of wheat or the preceding crop?

MR. WAKEMAN. We do not put them on to get a crop of wheat but more for the crops that come after.

MR. DAY. I have been somewhat interested in that fish question and I should like to ask a few more questions of the gentleman in regard to the value of the different fertilizers that he has used and what effect they have had upon his land. What is the effect upon your land of fish or fish pommace?

MR. WAKEMAN. I think we get all the benefit from fish the first year.

MR. SANGER. Isn't it a good investment at that?

MR. WAKEMAN. We have never found it so. There was probably a hundred tons within three or four miles of where I live, which was offered for about ten dollars a ton, and the farmers would not take it at that price. The past year some little was bought. We consider that when we put in ashes we never lose the effect. We always see the benefit of them as long as we cultivate the soil, and we consider a bushel of leached ashes as good as a bushel of unleached. I suppose the ashes came from Canada.

MR. SANGER. About how many bushels to the acre?

MR. WAKEMAN. Where we have not put on ashes before we generally put on two hundred bushels to the acre.

MR. HALL. What effect does that have upon your crops of rye? As much as on your wheat?

MR. WAKEMAN. We do not raise but very little rye. We never seed down with rye. Perhaps some gentlemen think I am telling a pretty big story when I say we lay out so much money for manures, but I think Mr. Gold will bear me out. He has been in that section of country, and knows what the farmers there use. I should think that in six miles square there were used the present year about 50,000 bushels of ashes, besides two hundred tons of bone dust and other fertilizers.

MR. HALL. Do I understand you to say that a bushel of leached ashes is equal to a bushel of unleached?

MR. WAKEMAN. We consider it so, and most of the farmers who use them think they are just as good after lying

in a heap as they are to use them right away, as they come from the pottery.

Mr. Hall. What is the cost?

Mr. Wakeman. Twenty-five cents a bushel.

Prof. Johnson. What is the character of your soil?

Mr. Wakeman. The soil is a deep loam, rather light. Some of it is rather yellow, and some of it is rather darkish.

Mr. Hall. What is the practice generally among farmers in that vicinity, there being so large an amount paid out for fertilizers, in making and saving their yard manure? Do they depend wholly on those fertilizers purchased outside or do they take pains to make a great deal at home?

Mr. Wakeman. They make all the manure they can. We are small farmers. There are large quantities of onions raised in that section of the country.

Mr. Hall. I have always noticed that it is a great deal better to make manure than to buy it; but I have also noticed that where there is a great deal bought there is apt to be a great deal made. On the other hand, I find that those farmers who take the least pains to make manure are the ones who buy the least.

Mr. Wakeman. I don't suppose there is any section where they take more pains to make manure than they do in the section to which I refer. They make all the manure they can, but the farms are so small that they rarely keep cattle for the express purpose of making manure.

Mr. Olcott. How much fish guano do you use?

Mr. Wakeman. I think there is hardly any used. We do not consider it as good as the other manures we buy.

Mr. Olcott. Would you use it if the price was less?

Mr. Wakeman. I don't think I should; still, I might use some.

Mr. Olcott. Why not?

Mr. Wakeman. Well, it don't pay. It is not lasting with us.

Mr. Olcott. Does it produce any effect the first year?

Mr. Wakeman. Yes, sir. I would say, in regard to fish taken right from the water, that I don't think it would pay

for carting in the summer time, when you are busy. I understand that Mr. Bradley offered to sell tons and tons of it for three dollars a ton to anybody, where he manufactures his phosphates.

MR. HALL. I would like to inquire what the principal crop is in that section that is turned off to market?

MR. WAKEMAN. Onions is the principal crop there. There are a great many potatoes raised, and a good many farmers, within a few years, have gone into small fruits.

QUESTION. I would like to inquire whether the gentleman has used, very extensively, fish manure?

MR. WAKEMAN. For two or three years, I and my two brothers, probably used fifteen or twenty tons; perhaps fifty tons in all.

MR. GOULD. I would like to make a statistical inquiry. I should like to know what is the maximum length of the straw crop. What is the greatest length of straw that has been known to grow in Connecticut, and what is the greatest length of head? And in asking the question, I will state what the fact is, so far as the state of New York is concerned. The longest straw that I have ever known to grow in the state of New York, was grown in 1871, eight feet and four inches; and the greatest length of head, eight and one-fourth inches. I should like to know if any gentleman present has known of anything longer than that for straw or head? I saw a field this Spring, of some ten acres, the heads of which would average eight and one-fourth inches.

QUESTION. How much rye to the acre?

MR. GOULD. About twenty-five bushels.

MR. BLAKESLEE. In 1816, I had a field of rye, the heads of which, I should think, (I didn't measure them,) grew from six to eight inches in length, with six rows of kernels. From two bushels of seed, I harvested sixty-nine bushels of rye. Rye generally has four rows of kernels, but these heads had six. I sowed this rye on the poorest piece of ground I had. I sowed a bushel to the acre. I don't believe anything near that could be raised on it again. That was the biggest crop I ever saw.

Dr. Riggs, of Hartford. Three years ago, I had a crop of rye on an acre and perhaps an eighth—not over that—where I have raised tobacco for years. My practice has been to sow rye to plow in for the next crop. After the tobacco crop is off, I sow rye, and by the time the ground is ready to prepare for tobacco the next year, my rye is four or five feet high. But three years ago, I had an old-fashioned man for a farmer taking care of my place, and he over-persuaded me to let the rye crop grow and harvest it, it looked so nice. It towered up so high, that I was a little proud of it myself. I had previously put on sixty bushels of leached ashes from Canada. By-the-by, there is a great deal of insoluble potash in leached ashes; the soluble potash is taken out in Canada; the insoluble sold to us; but it takes two bushels of unleached ashes to make one of leached, and there is where we get an advantage. I had the curiosity one day to measure this rye in different parts of the field, and I found that the straw was seven feet long, up to the commencement of the head. The heads I did not measure, but they were very long, and the observation of the whole neighborhood. When we harvested it, instead of cradling it, for it was toppled over a great deal, so that it would have been next to impossible to cradle it, we went in and mowed it as we would mow a double swath in grass, having one or two to mow, and one or two to follow after the mowers and gather it up. They placed it one side in small heaps, and then, when we bound it, we put two heaps together. We mowed it close to the ground, so that the stubble was not over an inch high. From that piece of an acre and an eighth, I got forty bushels of rye, two tons of straw, that I sold for $25.00 a ton, and about nine hundred weight that I sold at the rate of $30.00 a ton. I estimated that the field yielded me about $100.00. This was on tobacco land, and the grain was very large, and the straw the strongest and heaviest I ever saw. It was the "observed of all observers" in our neighborhood, as a rye crop.

Now one word in regard to the profitableness. The next season, I raised tobacco on that piece, and for my tobacco

crop I got $966.00. The crop of rye was a beautiful sight, but it did not pay like that vile weed they call tobacco.

QUESTION. What kind of manure was used for the tobacco?

DR. RIGGS. I bought 500 bushels of leached ashes from a canal boat that came up the river. Sixty bushels of that I put upon that field, and the remainder I spread over another field of twenty acres, a part of it tobacco land, and a part of it in grass. There can be no mistake, gentlemen, about the value of leached ashes. I had that impressed upon my mind by my father. When going across a field with him, he would frequently turn round to me, strike me on the shoulder, and say, "Remember this—*land never forgets ashes.*" He would go down to the village, a mile and a quarter away, and pick up all the ashes he could get, and cart them up the hill to his farm. He had a way of impressing these things upon our youthful minds, sometimes with a birch, and sometimes with his hand. I repeat, there can be no mistake about the value of ashes.

Adjourned to evening.

EVENING SESSION.

The meeting was called to order at seven o'clock, by Vice-President HYDE, who stated that the first subject on the programme was

OATS, BARLEY, AND BUCKWHEAT.

MR. GOLD. I have before me the agricultural census for 1860; that for 1870 is not yet completed, and in default of that, some reference to the census of 1860 may help us with regard to our discussions upon the relative importance of these different crops.

Connecticut, in 1860, is reported to have raised 52,401 bushels of wheat; 618,702 bushels of rye; only seven states of the Union being ahead of this little state in the production

of rye. Of Indian corn, we raised, that year, 2,059,000 bushels; of oats, 1,522,000 bushels; of barley, 20,000 bushels; of buckwheat, 309,000 bushels. Doubtless, since 1860, the production of rye and Indian corn in the state has considerably fallen off. I think there are many sections where other crops have taken their place.

The discussion this evening was designed to embrace oats, barley, and buckwheat. The range embraces the preparation of the soil, the different varieties, their culture, their market value, and their relative value, as compared with each other, and as compared with other farm crops. Very many important points in the previous parts of the programme have not been discussed; especially, the relative value of crops; and I hope that gentlemen will be free to speak upon this point, and that we may have some facts to present to the farmers of our state in regard to the profit of the culture of these different crops.

No gentleman seeming disposed to speak upon the subject announced, some little time was spent upon the question of the preparation of manures and their application, after which, the potato question was again taken up.

POTATOES.

Mr. Gould. I will mention a little experiment that I once tried with potatoes, with a view to ascertain if any gentlemen present have had corresponding experience. I had a piece of land where the soil was three or four inches deep, on a slate rock, covered with weeds and thistles, of a very unsightly character. To banish these, I put in potatoes, the hills about two and a half feet apart, over some ten or fifteen square rods, covering the ground, to the thickness of about two feet, with straw. I got from that piece, without doing anything else whatever, at the rate of 140 bushels to the acre. They were not, certainly, the best potatoes that I ever saw, but they were fair, sizeable, eatable potatoes. The only cost was putting on the thickness of two feet of straw, and the next year, the grass came in beautifully, and the weeds were all exterminated.

Mr. Gold. I will state my experience in regard to the culture of the potato this summer.

The Early Rose has always been a favorite with me. This summer, planted on rather light, dry land, the crop was a partial failure. Planted in the garden, upon rich soil, it did as well as ever. That was the general experience in that part of the state, so far as my observation extends, in regard to that variety of potato.

I planted some thirty varieties on trial; I will speak of only a few of them. The Peerless perhaps yielded as abundantly as any other variety. I had only two or three potatoes of that kind. I tried also a single potato—the Aróostook—sent me by my friend Gov. Hyde. The yield of that variety was very remarkable, perhaps equal to the Peerless. It is a very fine, large potato, promising to be a good one. Gov. Hyde also has a seedling, with some samples of which I have been favored, and that, in growth and vigor, seems to be unsurpassed by any other variety. It is rather late, and it remains to be decided how good a table potato it will prove; but I think its vigor is such as to recommend it; and if, after another year's trial, it proves to be deserving of public favor, we shall probably have it at your service for trial. The standard kinds which I have planted for several years—Garnet Chili, Gleason, and Prince Albert—all did well; Climax small in size and quantity, but of good quality. Breese's Prolific yielded abundantly, good size, smooth and of fair quality for the table. The King of the Earlies and the Early Mohawk did not show any superiority to the Early Rose.

There have been such various reports with regard to the yield of the Early Rose this year, that I wish gentlemen would speak upon that point. I think, however, it will be reduced to this: that in good soil, with proper manuring, the Early Rose did very well indeed—just as well as could have been expected. I saw it under a variety of circumstances. Among others, I saw it up in the region of which Mr. Gould spoke yesterday, in Franklin county, in northern New York. It grew there most magnificently, upon that virgin soil. Upon

light, dry land, the drought seemed to affect it severely, and in some cases it was a failure.

MR. LYMAN. I made some remarks yesterday upon potatoes, and I would like to say a word further. The potato, you will remember, that I spoke about yesterday, as having tried some experiments with, was the Garnet Chili; but I had other varieties. I planted six rows of that same potato in my garden the first day of July, and they came out when I dug them this fall very nice and large. There was nothing but a little phosphate in the hill. It was after I had used up all the ground that I cared about in my garden, I had a few potatoes left, and I put them in, more to see what they would do than anything else. It was very late in the season. The reason I speak of this is, that I have neighbors and friends in my own vicinity who planted the Early Rose about two or three weeks later than the ordinary time, and they failed to raise a respectable crop, or anything like it. Why this was I do not know. I have one instance in my mind particularly. A young man told me that the Early Rose which he got into the ground very early yielded him a fine crop of nice potatoes, but those planted late did not do anything at all; yet the ground was just side by side, was plowed, I think, at the same time, early; but for some reason, he planted a part of his potatoes two or three weeks later than the others, and they came out very small.

Now, in regard to the ground that I planted myself. I had two pieces, one of which was sandy land, and I planted that early in May, and I did not see but that the potatoes were just as good as they have been at any time; but as I stated yesterday, (and as there are some here to-day who were not here yesterday, I will repeat it,) the first year I planted them, I used very small pieces of potato. The next year, I increased the size, and last year I used still more seed, and I think that I find no falling off in size, while those of my neighbors who have followed the plan of using very small pieces each of the three years in which they have planted that variety, have grown only small potatoes, and comparatively few in a hill. On the other piece of my land, which was planted about the same time, I put ashes

in the hill, and I had a very handsome growth of potatoes. It was nothing but clear gravel, where, when you ran a plow through, it would rattle like going through a bed of oyster-shells; and yet, will you believe me, right on that knoll, where we could dig down and come to good sand for plaster, putting two double-handsfull of ashes, with no manure into the hill, we had from six to eight good marketable potatoes in a hill. The other part of the piece was on lower ground and richer, and the potatoes were proportionately better.

Mr. ———. The Early Rose is my favorite for an early potato. They seem to be good yielders, and do well as a general thing. Last spring, I had a very warm piece of land, and I planted my earliest potatoes about the first of April. They seemed to grow well enough, but they did not yield very well. About the first of May, I planted the last of my potatoes, and they were fit to dig about as early as those I planted the first of April. When you come to late potatoes, I planted, last May, a bushel of the Peerless, and they yielded beyond all potatoes that I have ever raised. I dug from that bushel last fall, twenty-one barrels of what may be called merchantable potatoes. There was only about a bushel of small potatoes in the whole twenty-one barrels. My mode of planting has been to plant in drills. I drop the pieces from twelve to fifteen inches apart, one piece in a place. I generally cut the seed pretty small. I think that, as a general thing, farmers put in too much seed for potatoes. I think, if you put in a great deal of seed, you have a great many tubers, and consequently have small potatoes. The Peerless seems to be an excellent table potato. I think it is rather the best late variety we have now. We cannot tell how long it will last, for most of our varieties, after a while, run out.

Mr. Lyman. Will the gentleman state his opinion as to whether they would require a strong soil? It is well known that there is a difference in potatoes in regard to the character of the soil they require.

Mr. ———. The Peerless yielded better than the Rose, with about the same culture. It was on pretty rich soil. I

should prefer to plant large potatoes, taking one or two eyes, not over two, in a piece.

MR. GOULD. I merely wish, as a stranger, to be allowed to compliment the farmers of Connecticut upon the exceeding modesty of their statements in regard to potatoes. It becomes every one who speaks on that subject to speak with a great deal of personal modesty, because it is utterly impossible, so far as my experience goes, to make any general statement with regard to potatoes which shall be a reliable guide for the practice of others. For example, the Harrison potato is very generally supposed to be one of the most prolific potatoes that can be grown. It is customary for those who are desirous of raising potatoes chiefly as food for stock, to raise the Harrison potato; but I believe it has been generally admitted that it is an exceedingly poor potato for the table; and yet, I am told that the Harrison potato, in Tennessee, is one of the most acceptable table potatoes they have. Such are the modifying influences of soil and climate, even at the distance of a few miles, that the experience of one man in relation to potatoes cannot be taken as a guide by another. You may remember that sometime ago the Monitor was quite the rage among farmers, and every one was seeking for seed. At that time, a gentleman from the island of Bermuda came to New York and secured a quantity of seed and carried it to that island. There the whole character and shape of that potato changed, and large quantities were afterwards sent as a very favorite potato to New York under the name of Bermuda Reds. They were very much more mealy than the Monitors ever were, and more acceptable as a table potato. These Bermudas being so much admired in New York, many farmers obtained them, and now they find that there is a Western potato so nearly like them that they cannot be distinguished apart. Here, then, is the same potato, the history of which has been clearly traced, which has assumed three different names, three different shapes, and three different qualities.

I do not know in all my experience with regard to potatoes, that I ever heard so general a verdict with regard to any variety as there has been with regard to the Early Rose. The

concurrent testimony of almost every individual who has tried them, is, that they are not only the earliest potato which can be relied upon, but that they are the best table potato that can be obtained; and yet there are parts of this country—very few, to be sure—where the Early Rose is not worth cultivating. In relation to the Peerless potato, I may say, that in the state of New York, there is no potato which on the whole has done as well as that has. The yield of that potato is superior this year to what it has been in any preceding year, and the abundance of its product has been exceedingly remarkable to every one. I think the same thing has occurred in some of the neighboring states. I do not know how it is in Connecticut, but I have been told that in New Hampshire their experience has been most decidedly in accordance with our experience in New York, in regard to the Peerless potato, not only with reference to the abundance of product, but to the excellence of its quality, which is decidedly superior to what it has been in any preceding year.

I mention these facts, not only in compliment to the farmers of Connecticut for the very modest way in which they have confined themselves to a statement of their experience, but also as a caution to every one who may be inclined to speak in high terms of a potato, with reference to its general excellence, to avoid doing so, lest they lead their brother farmers into very grave and serious mistakes. My own experience leads me to say, that every man should try on his own soil four or five hills of potatoes, and judge of their adaptability to his own farm, before he goes into any variety very extensively. I think, if gentlemen will follow this rule, they will avoid a great many mistakes, and the expenditure of a great deal of money, which would be utterly thrown away.

MR. GOLD. Is it not more reasonable to suppose that there was a mistake in the seed of the Monitors shipped to Bermuda than that a white potato was changed to a red one?

QUESTION. I will ask Mr. Acland how he raised these twenty-one barrels?

MR. ACLAND. They had no extra care, more than the ordi-

nary potatoes that I planted. I used, perhaps, a little phosphate.

Mr. Stewart. The Early Rose that were planted after the first of June yielded a heavy crop of very excellent potatoes; those that were planted from the 10th to the 20th of April, were an entire failure. They did not pay for the cultivation and digging, owing probably to our extremely dry weather the last of May and the first of June. In some small experiments with potatoes that I made last year, the Early Rose did the poorest of any of them; whereas, other potatoes, the yield of which had generally been less, yielded more than the Early Rose. The Peachblow potatoes, in our section, did remarkably well last year. Two-thirds of an acre of Peachblow potatoes that I planted a few years ago, on the 3d of June, yielded at the rate of 600 bushels to the acre. This is a large statement, but the ground had been dug over from eighteen inches to two feet deep, and heavily manured. I was preparing the place for tobacco. Of the Idaho, which is a new potato, sent out last year for the first time, the yield was twenty-seven times what was planted; of the Peerless, the yield was eighteen times; of the Excelsior, the yield was thirteen times; of the Early Rose, eleven times; of the Aroostook, thirty-six times what was planted. The seed potatoes, with the exception of the last named variety, were all large, some of them exceedingly so, and cut into pieces of three or four eyes. The Aroostook was raised from single eyes, and the increase was thirty-six times. Where I raised the Early Rose, two years ago, from single eyes, they produced a much larger yield than where I planted large potatoes.

Question. What was the preparation of the land for the Early Rose?

Mr. Stewart. There was no special preparation; it was simply sandy loam without any manure.

Question. What was there for the Early Rose to feed on? Was it good soil?

Mr. Stewart. I thought it was; it was for other potatoes.

Mr. Lyman. I wish to enquire if there is any gentleman

in the hall who ever raised or who ever heard of a variety called the General Grant?

Mr. Gold. I had a sample sent me from Maine of that variety, in a box with a dozen others. One of the varieties did not grow at all, but aside from that the yield from the General Grant was the smallest of any, and I discarded it.

Mr. Lyman. I asked the question because I have had some experience with the General Grant, and I thought if nobody else in the world had ever raised such a potato or ever heard of it, I would keep quiet; but it seems it has dropped down into our Secretary's hands, and he had rather bad luck with it and now I will state simply my experience with it. I had four of them, and made about twenty hills, and they turned me out a bushel and a half, but they were not remarkable for size. They were the yellowest potatoes that I ever saw. I think the man who gave them to me spoke of their fineness of grain as one quality, and they proved to be fine-grained; but when cooked they were almost as yellow as saffron. As to their eating qualities they were certainly, if eaten soon after they were cooked, a very good potato.

Mr. Gold. While from that one Aroostook I gathered half a bushel, from this single specimen of the General Grant that I planted, which was not quite as large as the Aroostook, I did not get more than two or three quarts. We cooked them and found them quite an indifferent potato, but I should hardly think they were as yellow as the gentleman states. I am sure we did not save any for seed.

Mr. Yeomans. I have no potato experience to relate, but last summer I conducted some experiments that have a bearing upon some of the suggestions which were made yesterday in regard to the part of the potato from which the seed should be taken; and I regret that in consequence of my necessarily hurried departure from home, I omitted to take my figures with me. In preparing the seed, I cut the potato as nearly as I could judge (and they were good sized potatoes) so that there should be about the same number of eyes upon each of the parts, and they were planted in rather light sandy soil, in a good state of fertility. The fertilizer which I applied

was gypsum and ashes, about a handful in a hill. The season being dry, the result was not as satisfactory as I might have hoped for; but at the same time the conclusion at which I arrived was, that the middle of the potato produced the most, the seed end produced the least, but the butt end (which I think was similar to the experience of some of the gentlemen who referred to that matter yesterday) produced the largest and best-sized potatoes, as a general thing; that is, they were more even in their size. There were not so many small ones; and of the three parts, the seed end produced the most small potatoes. But, as I said, this was only one experiment, and was not satisfactory. I propose to try it again.

Then, some three or four years ago, I tried an experiment with regard to the different modes of fertilizing the potato. I think I tried four different modes; plaster, plaster and ashes, barnyard manure, and barnyard manure with plaster and ashes. I found that where the mixture of the plaster and ashes was applied, the success was more marked; that is, the crop of potatoes was considerably increased. And where the manure alone was used (it was rather coarse manure) there was an increased number of potatoes, but they were not sound. I do not recollect that there was a single decayed potato that came from the hills manured with plaster, plaster and ashes, or where the manure was used in connection with plaster and ashes, whereas, in the hills where manure alone was used there were a good many potatoes that were partially decayed. I accepted that as an evidence that it is not the best policy to plant potatoes upon manure; and that, I think, agrees with the suggestion of some of the gentlemen yesterday.

Mr. Robinson, of Hampton. From the experience I have had in raising potatoes, I find that from some peculiarity in the season, early potatoes do much better some years than late, while some years late ones do the best. For instance: a year ago this last summer, and two years ago, early potatoes, with me, and, I think, as a general thing through this county, did much better than late ones. I have planted, for the last two or three years, about three

acres. Those two years of which I spoke I only planted half an acre of Early Rose. They yielded the best of any kind I planted, and I considered them the best potato to eat, and they were the most salable. Last year I thought I would go in largely for the Early Rose and raise what would bring me the most money. I planted the three acres with Early Rose. In the first place I planted a few in my garden, about the 20th of April. Those were sprouted, which I consider, on such ground as mine, very important. My soil is a moist, gravelly loam, mixed with clay. I cannot plant very early; if I do they rot. Therefore it is very important for me to set them out somewhere, in boxes or baskets, where it is warm, and let the sprouts start somewhat before I plant them. Then I plant them about the 20th of April, and I get potatoes about as early as any one. Those I planted first yielded well. After that, about the 10th of May, I planted two acres of Early Rose potatoes, and about an acre of later potatoes, of different kinds, at the same time. Those which were planted about the 10th of May were not entire failures, as Mr. Gold says, but they were a slim crop—did not come up hardly to mediocrity.

Now, if it is proper, I want to state to this meeting an experiment which I tried with Mr. Hayward's Mineral Compound. And in stating this experiment, I want to do it in all fairness, for I have certainly no prejudice for or against his preparation. He came along last spring and lectured in my town, and I went to hear him and was somewhat pleased with his lecture; so much so that I joined a class and went in and heard his course of lectures. And certainly he made everything appear plausible and I hoped for the best; for if there is any way by which we can raise larger crops with less expense than we do now, we want to know it. I bought his book and tried his mineral compound, and did as he requested me to do. "Now," said he, "I want you to try this thoroughly, and I want to tell you how to do it. I want you should try it on potatoes. Take a spot of ground and put on at the rate of a ton to the acre; plow it in, and then cross-plow the ground, so as to mix it up well with the soil." I

did so. I plowed up a quarter of an acre and put on four hundred and fifty pounds, and then I cross-plowed it, as he requested me. The rest of the two acres I only plowed once. It was old ground, where potatoes were planted years before. On the other acre and three-quarters I put a shovelful of compost in each hill. It was manure taken from the hog-yards, the stable, and all about, and composted together. It had been pitched over once and made fine. As I say, I put a shovelful of that manure in each hill, and put about a tablespoonful of super-phosphate in a hill, and I also put about the same quantity of super-phosphate in the hills where I put the Mineral compound. Now for the result: when I came to dig the potatoes, where I used the compost in the hill, it took from thirty to forty-five hills for a bushel; where I used Mr. Hayward's Mineral Compound it took from sixty to seventy-five hills for a bushel. I notice, in our county papers, certificates signed by a number of good farmers in Woodstock, who have used his Mineral Compound, and they speak well of it. If there are any of those gentlemen here to-night, if they will give their experience, and tell wherein they have derived any benefit from it, I certainly would like to hear them, for we want all the light we can get upon it. It is cheap. He says that a ton of that article can be made for $9. That is so; but when he says that a ton of that compound, manufactured for $9.00, is worth as much as a ton of super-phosphate, that remains to be proved to me, for I have not seen it.

I also tried it on carrots. I spread a field all over with manure and then took a strip about two rods wide and sowed on this compound, and I could see no difference in the growth of the carrots while they were growing, and when I came to harvest the crop the carrots were no better on that strip than on the rest. Now, to be fair about it, I will state one thing further; for if there is any good in it I do not want to hide it. The vines of the Early Rose potato which I planted on the two acres where I put the compound and where I put the manure, died early, and after the vines died the weeds sprang up all over the field, and there was a much greater growth of weeds where I put the Mineral Compound than where I put

the manure. Now, if there is any value in that compound, that kept itself back and showed itself in those weeds, I do not know but I may get some benefit from it another year.

MR. PERRY, of Woodstock. I used Mr. Hayward's Compound last spring, in a small way, on potatoes. I cannot speak distinctly as to the benefit I derived from it, for I used it on the whole piece and left none without it. I had about an acre with no other manure than this manure compound. The result was, I had a good crop of potatoes, as good as I have ever raised. I used it on a piece of mangold-wurtzels, and there I saw a marked difference, for I used it only on a part of the bed. I should think it increased the beets one-third; and otherwise they were treated all alike. There are others in our town who have used it on corn, and been satisfied with the result, as far as I have heard, and I have heard of some who are making preparations to use it on a larger scale next spring.

MR. DAY, of Brooklyn. I have had some considerable experience in the cultivation of potatoes, and last year my crop was a failure. The ground was cropped with rye the year previously, a liberal coating of long manure spread on the surface, and the ground plowed to the depth of about six inches, harrowed, and marked into rows three feet or a little more apart. My custom has been for the last twenty years, since the potato-rot began to show itself, to plow in my manure; to plow the ground to the depth of about six inches, harrow, and then run the plow down some three inches into the soil, drop the potatoes about twenty inches apart, and keep the ground as nearly level as I can. I have had excellent success with the Early Rose. In the earlier part of my cultivation of it, when it first came into notice, I raised nearly or quite a hundred to one. Afterwards, I purchased the Climax potato, from four pounds of which I raised nine bushels and seven pounds—one hundred and thirty-seven to one. That was two years ago this harvest. Since that time I have failed to raise a good crop of potatoes. I attributed the failure last season to the dry weather just before the dog days set in, the 24th or 25th of July, when my potato-tops were looking very finely.

That drouth came, the tops died, and consequently I had a very slim yield of potatoes.

I have heard some gentlemen speak about putting ashes in the hill. My experience has been, in the cultivation of potatoes, that ashes on top of the hill do much better than in the hill. When they are put in the hill the potatoes are often rough and present an uneven surface, whereas, when put on top of the hill, they are much smoother, and my impression is that ashes or even plaster is as beneficial on top of the hill, and perhaps more so, than in the hill. In a number of very scientific experiments made by the Massachusetts State Society, the result was almost invariably in favor of the application on top of the hill, of ashes, plaster of Paris, and other fertilizers that are not volatile. Some ten or twelve years ago, Mr. Dyer, the former secretary of our State Society, suggested to me the propriety of using a mixture of ashes, salt, and plaster, at the rate of ten bushels of ashes, a bushel of plaster and a bushel of salt, mixing them together some few days before I wanted to use them. By the by, I might say, that when I make that application I do it immediately after planting, before the tender shoots come up. I had had very poor luck in raising good-sized Dover potatoes, and I took about one-quarter of my ground that season and made this application of ashes, salt, and plaster, as suggested by Mr. Dyer, and I never saw finer or more sizable Dover potatoes than I got from that field. That, I believe, was a wet season. I tried the same experiment afterwards, without any visible result.

Considerable has been said in praise of the Peerless potato. I thought a great deal of the Climax from its great productiveness the first season I planted it. That was two years ago when the potato crop was very good with us. I gave some of them to a friend of mine in the town of Pomfret, who planted them by the side of the Peerless. I called upon him sometime, I think, in the month of September, and he asked me to look at his potatoes. He dug a hill of the Peerless and a hill of the Climax, and I must confess that I never saw more beautiful looking potatoes, or a more abundant

yield, in my life than those Peerless. I think that they would yield one-third more than the Climax, if not twice as many. I think that he said they were a good quality of potato.

Mr. Lyman. Just one word. I think the difficulty in regard to potatoes manured with ashes not coming up, is owing to the fact that a heavy rain comes immediately after planting, while the ashes are near the top of the ground, and there is such a strong lye made that it destroys the growing tuber. On wet ground I should certainly never put ashes in the hill, but on dry ground I would put them there, for I think they attract moisture and tend to keep the ground more moist, and the plant will be more likely to grow.

Question. Has it been decided whether it is better to hill potatoes or not?

The President. I will say that it is pretty generally conceded that a shallow covering is the most desirable. Last spring I was desirous of reclaiming a piece of land that I had which was quite bushy. The bushes that predominated were thorns, to which I was compelled to hitch my cattle to extract them from the soil. This was quite early in April. In reclaiming this land I thought I would try the experiment of planting in a furrow, dropping in my manure and potatoes, and then passing a plow along and covering the potatoes by the plow. Being on a steep side-hill, I had the advantage of a swivel plow. I think I covered those potatoes not less than seven inches, and some of them probably nine. As you would naturally suppose, they were a long time in coming up, but the result was, the best potatoes that I gathered last fall were the potatoes that were covered to this depth. I planted three furrows of Silver Lake (the Mercer proper), the Early Rose, and a seedling of my own, of which Mr. Gold has spoken. The yield of Early Rose was very light; my seedling gave an excellent crop, and I think that the Mercers were somewhere about three-fourths that of my own seedling. I think the yield of the best of them was not less than three hundred and fifty bushels to the acre. Now, my principal object in stating this, is, to know whether or not the turning of this furrow over upon them to that depth, was best, and the cause

of the successful result. You see the potato was covered to a great depth.

Mr. WHITE, of Putnam. I think we have now hit upon one of the most important questions connected with potato raising. Some thirty-five years ago I remember that my grandfather let out half of an eight-acre lot to be planted. The man who took the four acres to plant planted his potatoes very deep—as much as four inches, at least. My grandfather did not plant his more than half as deep. It was a level piece of clay land, deep loam, which would stand a drouth well and which would stand wet well. The result was that our half of the potatoes on the part that we let out was worth more than the whole on our own piece: and I have noticed it invariably, that where I have covered deep I have had the greatest yield of potatoes. Two years ago this last spring I had a young man from West Woodstock planting, and I charged him to plant very deep. After speaking to him as much as a dozen times while he was planting four rows across the piece, and not being able to get him to do it I thought I would put him to shoveling, and planted the rest of the piece myself; and on that part of the piece which I planted deep, there were twice as many potatoes as there were on the other part. I have never known it to fail. I would not think, on good loamy land, of planting potatoes less than three or four inches deep. As the chairman spoke about their coming up late, you will find that potatoes, as a general thing, will come up much quicker if planted four or five inches deep than if planted only two inches; and I have observed for years that the quicker the potato comes up after being planted, the stocker and more rugged it is, and it seems to maintain that vigor, other things being equal, through the season.

Another point has been suggested—in reference to planting small potatoes or small pieces. I have tried that experiment for years. My experience has been, that if you pick out your largest potatoes to plant from, year after year, no matter what the kind is, you will find that you will have less small potatoes, after you have tried it two years, and a greater yield. That has been my invariable exnerience. I never

saw much difference, in planting small potatoes one year, but the second year they would run down; there would be none so large and there would be a great quantity of little ones. My experience has been that large potatoes, cut, have always given me the best and the most sizable ones, and the greatest yield.

For the last ten or fifteen years I have used, almost invariably, ashes, plaster, and lime, mixed, and every time I have left rows where I have not used this mixture, to see if it had any effect, I have found that I have got a better yield and better potatoes where I used it, and they have generally been more free from rot. Before the potato-rot came on, I used to manure very heavily in the hill, and got large crops, but I found that I must abandon that, and since then I have plowed in my manure and used plaster, lime, and ashes. This last year I tried a different experiment on a piece of land a little sidling, descending to the southwest—a deep, yellow loam. I plowed perhaps six inches deep, and plowed in coarse manure. Then I took green manure from the windows of the barn, and put a half shovelful in a hill. Then I took a a small handful of that lime, plaster and ashes, and put in the hill and made my men cover it as deep as I could, keeping watch and talking all the time. They came up very well and looked finely. About the time of hoeing, the bugs troubled me considerably; the vines were perhaps nine inches or a foot high, and they began to eat them. So I took plaster and sowed it all over the vines when the dew was on them. I think those potatoes were planted about the first of April; they were plowed a second time in August, and kept green until the frost came. I rather attribute their keeping green so late to the plaster I sowed on them. I will say that by cutting the larger potatoes you have fewer stalks in the hill, and they grow more vigorously. The first time I tried this experiment of plowing in the manure and using plaster, ashes, and lime, I cut my potatoes very fine and I did not use quite five bushels to the acre. You may think that was too little. One, two, three and four stalks came up—very seldom five. In digging those potatoes I watched very closely, and I no-

ticed that the hills that had two or three stalks invariably yielded the most. This was yellow, loamy land. My process was this: I put on from twenty to twenty-five loads of good hog manure, spread it over the ground, and plowed it in. I did not harrow or brush; I never do that for anything, because I think it is a waste of time and makes harder work in cultivating my land. I plant not more than the thickness of the potato below the soil, cover them deep, and I have invariably got good crops in that way.

MR. GOULD. I am unable to give you any information from my own experience in relation to the deep planting of potatoes. With regard to the question of Gov. Hyde, it seems to me that there must necessarily have been from the circumstances of the plowing, a very great degree of pulverization. In that case, there would be an admission of air through the interstices of the soil, which would, in point of fact, be equivalent to planting the potato more shallow. The access of air would be the same. Such would be my opinion.

Mr. YEOMANS, of Columbia. Perhaps the practice of a neighbor of mine which I have noticed may throw some light upon that question, and I will relate it as near as I can. After the ground has been plowed, preparatory to planting, it is furrowed rather deeply. Into this furrow he strews fine yard or composted manure. Then I think he cuts his potatoes into pieces, with from two to three eyes to a piece, and drops those pieces from a foot to a foot and a half a part. Then he takes his team and covers them with two furrows. In that condition the field is left, until the potatoes just begin to show themselves above the surface; then he takes a light harrow, with short wooden teeth, from four to six inches long, and harrows it over thoroughly, so that in fact it leaves the ground level, removing the weeds; and in hoeing, it is left as nearly level as possible. So far as I have noticed, he invariably has good success in raising potatoes. He always gets what may be termed a large crop of good-sized potatoes—from 250 to 300 bushels to the acre.

Perhaps a little personal experience that I had the past season may apply to this same point. I planted some potatoes

in a furrow, with the hills some two feet apart. The furrow was quite deep, and I put in it for a fertilizer, a shovel-full of partially decayed buckwheat straw and old hay. It had arrived at such a state of decomposition that it was fine and very loose. I dropped the potatoes and covered them quite deeply. In hoeing, the ground was left very nearly level. I cannot say whether the old straw had anything to do with it, but when I came to dig the potatoes, I found them the cleanest and nicest I ever raised, and as large.

Mr. Hart, of Cornwall. My own experience in relation to potatoes has led me to three conclusions: first, that it is necessary to select pure seed; second, that it is beneficial to change the seed often; and, third, that we should adapt the cultivation to the habits of each variety. For instance, in the Early Rose, if the cultivation is shallow, a part of the potato will be exposed to the sun and the light, and will turn green and be very much injured. My own practice the past season has been like this: One section of my piece of potatoes was planted with Early Rose, the next with Peachblow, the next with Colebrook Seedling, the next with a mixture of Colebrook Seedling and the Dover. Last year, I planted my Early Rose shallow, and probably one third of the crop was ruined for table use from its exposure. This year, I plowed a deep furrow, and put them into the bottom of the furrow, and in hoeing, I instructed my hands to cover them well. The consequence was, there was no exposure, and not a single tuber was injured. In part of the hills I put in, just for experiment, perhaps a table spoonful of Coe's superphosphate, which produced a smooth potato, as smooth as an egg, and of uniform size. There were hardly any small potatoes, and none of them too large for table use.

The Peachblow is a potato that, with me, grows deeper in the soil, but I planted it the same as the Early Rose. The tops grew enormously, and blossomed like a flower bed. The produce from them was a little over half what it was from the Early Rose.

Now I am going to touch upon another point, that may call out the experience of others; and that is, in relation to the

purity of the seed. A few years ago, my seed having deteriorated, I obtained of a neighbor some Colebrook Seedlings for seed, and the result was very satisfactory. I was raising the Dover at the same time, and I became negligent and allowed the seed to get mixed, and planted them together for two or three years. I wished to secure again, for spring use, the Colebrook Seedling, and last spring, I selected with my own hands all the Colebrook Seedling variety, rejecting entirely all the potatoes that had any appearance of the Dover. I supposed I was going to get the pure product of that variety. I went to the field myself and saw them dug, and I do not know that there was a hill of pure Colebrook Seedlings; there was a mixture still. I could not account for it. I do not know whether any one has had the same experience or not.

One thing more, in relation to the question the gentleman asked about hoeing potatoes. One season, owing to sickness, there was about a quarter of an acre of my patch of potatoes that went unhoed. It was planted as nearly upon a level surface as possible. The piece was a little stony, and it was not furrowed out, but places for the potatoes made with a hoe. There was no after cultivation upon that part of the piece, but the best potatoes we had that season grew upon that piece of ground. The difference was decidedly in favor of this level and uncultivated part. But there are certain conditions which should be observed in these experiments. This quarter of an acre to which I refer had never been plowed before, that I know of, and that may have been the reason; the other land had been cultivated. So that the condition of the soil, after cultivation, and manuring, must all be taken into consideration, because all these circumstances go to vary the result; and it is just as important to know these various conditions and circumstances, as it is to know the result, and perhaps more so.

Dr. Riggs. Were those potatoes hybrids? That is, were they crossed?

Mr. Hart. No, sir. They were distinct in the same hill, Colebrooks and Dovers, where I took the utmost pains to select nothing but Colebrook Seedlings.

Question. Is it not rather difficult, in the spring of the year, to pick out the Dover from the Colebrook Seedlings, and some others? Do they not undergo certain changes, so that the variety is not so easily determined in the spring as in the fall?

Mr. Hart. Both varieties have very marked characteristics. The Colebrook Seedling is an oblong round potato, with eyes even with the surface, while the Dover has more of a spherical shape, with deep, hollow eyes. The characteristics are so distinct, that it is not very difficult to distinguish the varieties.

Dr. Riggs. They must have been hybridized, if the gentleman planted nothing but Colebrook Seedlings, and there were two kinds in the hill when dug. I thought the question had been settled, that potatoes would not mix in the hill.

Mr. Sanger. I am aware that the hour is late, but I would like to say a word upon a single point in this connection, which has not been touched upon, as to varieties in potatoes. Before alluding to that, however, I will say, in reference to the remark which has just been made, that I have found in my experience, that it is very easy to be deceived. A few Dover potatoes mixed with other varieties will very much deteriorate them, because the Dovers are prolific in small ones, and we are in the habit of planting small potatoes, and unless a man is a very careful observer, he will find the Dover when he thinks he has planted the Garnet Chili. We do not select our seed in the fall, but put our potatoes away in the cellar, and in the spring, many plant what are left, and plant Dover potatoes, when they think they are planting something else. They will get the Davis Seedling and the Chili, which closely resemble each other, mixed, and when they undertake to sort them, they will pick up a great many that they cannot tell whether they are the Davis or the Chili.

I was going to speak as to varieties. Our farmers are beginning to find out what kind of potatoes to raise. There are more Davis Seedlings, I venture to say, in this region, than any other kind of potato, and they meet with the readiest sale. It is impossible to sell the White Rusty Coat. It is

no use raising them with the expectation of selling them in our villages. Our foreign population occupy a good many farms, small places, and raise a great many potatoes for market, and they almost invariably plant the Davis Seedling. But I can raise more good sizable potatoes for market from the Garnet Chili than from the Davis Seedling, and I know other farmers whose experience corresponds with mine. The Rose for early planting, the Garnet Chili and the Davis Seedling, are the three standard varieties in this region. We have a great market for potatoes in all these villages, and besides, there are thousands of bushels sent to Providence, and the Seedling will sell as readily as any. I can sell the Davis Seedling in these factory villages sooner than the Early Rose; but the Early Rose is sought after by our native-born population. They would rather have it than the Seedling.

Mr. Robinson, of Hampton. A very important question has been asked here this evening in regard to hilling potatoes. I do not know that it has been answered satisfactorily, and I do not know that I can answer it satisfactorily to the gentleman who made the inquiry. A number of years ago, I lived in Canterbury, and improved a farm that lay in the valley of the Quinnebaug. It was dry, sandy, or gravelly soil. I came to the conclusion, from experiments that I tried there, that flat cultivation was the best. I afterwards moved to the hilly land in Hampton, away from the river, on a gravelly loam, mixed with clay, and there I have tried the same experiments, and I find I have much better success to hill my potatoes. I have come to the conclusion that on sandy soil, flat cultivation is the best; but on a different kind of soil, like that I am now on, it is better to hill them. I used to think it was better to spread the manure, but I now find that I can do better by putting the manure in the hill. My soil is wet, and I have to put the manure in the hill to keep the potato out of that wet, cold soil, and I can do much better there to hill my potatoes.

The matter of harrowing has been alluded to. Last spring, I happened to be in Pennsylvania, and I saw them bushing their potatoes after they came up. It looked to me like rather harsh treatment.

Mr. Gold. I stated yesterday that I used the Thomas smoothing harrow this last spring, with excellent results. It destroyed all the weeds, and pulverized the surface. It was done just as the potatoes were coming out of the ground. It scarcely disturbed one of them, and answered a most excellent purpose.

Mr. Currier, of Bridgeport. Is not the *time* of hilling of more importance than whether flat-hilled or not? My experience has been, that if you hill potatoes after the tubers begin to set, it destroys more or less of them, and invariably makes an inferior crop. I never allow myself to hill my potatoes or disturb the ground after the tubers begin to set. If I do, I never get a good crop.

Mr. Hubbard, of Middletown. I have practised harrowing potatoes for a great many years. I think it is the cheapest way of cultivating them. I never give them but one hoeing afterwards. I have sometimes harrowed them two or three times, the last time after the potatoes appeared so that you could discern the rows across the field. Although it seems, as the gentleman says, like rather harsh treatment, I have never found that the plants suffered at all. I have used the common harrow, just the same as I would in any other field, and I think the practice is one that accomplishes a great deal of labor with trifling expense.

Mr. Wakeman. We all admit that it is best to change the seed. Does it make any difference whether we get the seed north or south, in regard to the earliness or lateness of the crop?

Mr. Lyman. I can introduce a little illustration on that point. As I stated yesterday, a cousin of mine, in Columbia, planted some potatoes that came from Mr. Breese in Vermont, with others saved by himself for seed, and in digging them he found that the potatoes which grew from the Vermont seed—they were the Peerless and Breese's King of the Earlies—were a week or ten days earlier than those which came from his own seed.

Mr. Gould. The gentleman behind me has suggested a question of very considerable importance, as it seems to me. My

own experience coincides with that of one gentleman who has spoken. I have invariably found that when potatoes have been hoed after the tubers had started, a new set makes its appearance, and the result is a whole hill full of small, worthless potatoes.

Col. Mead, of Greenwich. I merely rise to express an idea that was fully concurred in, I believe, by the potato-raisers in my section, and that is, that the cultivation of the crop ought to be closed about the time the blossom buds make their appearance.

Mr. Yeamans. Is it not a fact that these small potatoes will set after each hoeing, if there are three ?

Mr. Gould. I have found it so.

Mr. Lyman. That is my experience exactly. Every year we have a lot of these little potatoes that never come to maturity. My practice has always been to close the cultivation as soon as I see the blossoms come, because I think it injures the crop to disturb them afterwards.

Mr. Gould. Will you allow me to make an inquiry for my own satisfaction ? I wish to inquire what is found to be the most economical mode of digging potatoes in Connecticut ?

Col. Mead, of Greenwich. I would say a word in relation to my method of planting potatoes. In the first place, I usually plant them in drills and cover them with the plow, using two horses so that one shall be on one side of the row and the other on the other—covering them perhaps six inches deep. About ten days after they are planted, I take a light inch and a half plank, ten inches wide, the lower edges champered off, with a couple of handles on it, and go over the field. This takes off about two and a half inches from the top of the ridges, cleans them off, and the potatoes come up without any weeds whatever. As soon as the potato makes its appearance I start the plow, which destroys the weeds between the rows, and my potatoes are nearly clean. By this method but little or no hilling is required.

As to digging ; I run the plow each side, and it facilitates digging fully one-third. A man can go over a large piece in a day with a couple of horses, so as to carry the plow steady —no dodging.

Mr. Yeomans. There is one other matter, that was alluded to by the gentleman from Hartford, that I should like to hear something said upon, and that is, in regard to mixing potatoes. He intimated that the question was settled that they would not mix. I will state a couple of instances and then I should like to have them explained, if possible. In one case, a variety called the Rhode Island Peachblow, which is known as a white potato, with splashes of red occasionally on it, was planted by the side of a red potato, the name of which I do not recollect, and in digging the Rhode Island Peachblows there were a great many potatoes found in those hills that were entirely red, and similar to the red variety planted by the side of them, whatever it was. The next year those that were supposed to be pure Peachblows were sorted out and planted; but they yielded a much larger proportion of that red variety than the first year. Then another case which occurred some fifteen or twenty years ago. There was a kind of potato raised called the "Black or Silver Lake," and that was planted by the side of a very light red or pinkish variety, and while the black potato did not change in the least, the stem end—the bud end, I might say—of the pink potato was noticed to be of a very dark color, approaching the color of the black potato; and upon planting some of those potatoes the next year a large proportion of the product was nearly black. Now if there was no mixing of those potatoes, I would like these facts explained.

Dr. Riggs. It is the most difficult thing in the world for any person to go into his cellar in the spring of the year (I find it so, at least) and select from the various kinds of potatoes there, all of a particular variety, unless, in the fall of the year he has been very particular to barrel up those he wants for seed and put them one side, for the women, when they go down to get potatoes, take some out of one bin and some out of another, and throw them around in all sorts of ways. The result is, that when the man goes to get his seed potatoes in the spring he is very apt to get some, at least, of the wrong kind. From the very nature of potatoes they cannot mix in the hill. The potato, in the first place, is not the seed; it is merely a

part of the plant. To put it in the ground in a certain form and have a different kind of potato come from it would be something as if you should cut out some branches of an Isabella vine, cut them up into lengths of one or two eyes, keep them in your cellar until spring, then plant them out and get Hartford Prolifics or Concords from them. The potato seed is from the balls and that is the only seed that the potato has. If there is any gentleman present who has been accustomed to hybridize potatoes, and to grow them from the ball, he will testify to the fact that by fertilizing the blossoms of one kind of potato with another, he can get a great many different kinds of potatoes from those balls by planting the seeds. The first year they will be very small; the next year the product will be a little larger, and the next a little larger still. That is the way the Rev. Mr. Goodrich has obtained the Garnet Chili, the Early Goodrich, the Pinkeye Rustycoat, and half a dozen other kinds which he has given to us. Only a few of the thousands he has cultivated have proved to be worth one farthing, but those he has given us have restored, as it were, cur potato crop from the almost annihilating rot; and from that source alone we shall have to recuperate that excellent esculent, without which neither this nation nor any other can get along. We must recuperate it occasionally. There must be some Rev. Mr. Goodrich, or some other gentleman, whose love of agriculture is almost a passion, to take the same trouble in a few years more, and give us a new series—perhaps of the Early Rose or some other potato more excellent still.

Mr. Yeomans. My impressions and my convictions would have been precisely the same as those of the gentleman who has just taken his seat, if it were not that they had been interfered with by the fact I have stated. Why was it that the first year (without any chance to mix in the cellar, to which the gentleman has referred) the planting of those two varieties, side by side, produced a different kind. I will say, to preclude the idea that there was any mistake, that those potatoes were very marked in their characteristics. It was not the case of the selection of two red potatoes so nearly alike that it would be almost impossible to make a distinction, but one of

the varieties was nearly white, with those splashes of red; the other a red potato.

THE CHAIRMAN. How do they differ in quality?

MR. YEOMANS. The quality was decidedly given to this mongrel by the red potato. It is poor. It is not fit to eat.

MR. OLCOTT. I have raised the Rhode Island Peachblow, called the White Apple, and I have noticed that some seasons it has been much redder than in other seasons, and the years when the potatoes were red the quality was invariably poor. The other instance of the apparent mixture of the old Black Mercer with some other potato, I cannot account for, but the red patches he observed, it seems to me, are easily explained. I have observed the same thing with the Red Peachblow a good many times, to my chagrin. I do not like them.

Adjourned to Thursday, at 10 A. M.

THIRD DAY.

The meeting was called to order soon after ten o'clock on Thursday morning by Vice-President HYDE, who stated that Prof. Johnson would continue his lecture of yesterday.

SOIL EXHAUSTION AND ROTATION OF CROPS.

PROF. JOHNSON. I was speaking yesterday on the peculiarities of plants which enable them to act differently on the stores of nutriment which may be supplied to them in the soil. I spoke of the differences in the absolute quantity of roots which various plants put out into the soil, and also of the differences in the depths of roots; and gave some illustrations on those points. I propose to speak this morning of the different structure of the foliage of plants.

We know with absolute certainty that a large share of the

feeding of the plant is done through the leaves. We cannot certainly tell how much goes on through the leaves and how much through the roots, in highly manured and very rich soil, but experiments have demonstrated that all the carbon of the plant (which is about fifty per cent. of the weight of the dry plant) may come from the atmosphere; it is not necessary that any of it should come from the soil. The seeds of various agricultural plants—Indian corn, oats, barley, etc. —have yielded a larger increase under artificial circumstances, where the roots had no carbon whatever at their disposal, than is ever produced under field culture. It is a well-known fact of agricultural practice, that soils which are nearly destitute of vegetable matter, and therefore have no considerable source of carbon in them, will produce large crops. Some very sandy soils, containing but little carbon, may be made to produce heavy crops by irrigation. Crops are also raised on soils free from organic matter, or from sources of carbon, by the aid of fertilizers which themselves furnish nothing of that sort.

Carbon, then, which makes up half of the weight of the dry plant, is always chiefly supplied by the atmosphere and may be supplied by the atmosphere exclusively. It is not necessary that it should be in the soil. The nitrogen of the plant, which forms indeed a small proportion—two per cent. perhaps, as an average—of the dry plant, is still an important ingredient, for without it vegetation cannot exist.

Some crops have the power of gathering nitrogen without any difficulty; they not only supply themselves with it but they even cause its accumulation in the soil. There are other crops which are dependent upon artificial supplies of nitrogen, unless the soil be naturally very rich in this element—crops which, if we undertake to raise them continuously on the same field, presently begin to show that they lack something, while if we apply nitrogenous compounds as fertilizers, the growth is ensured. We do not know in full detail how plants acquire a sufficient supply of nitrogen from the atmosphere, but we conclude, with great probability, from the results of practice, that different plants draw on the natural supplies of nitrogen in a different way.

Let us consider how the structure and habits of two typical crops, wheat and clover, stand in relation to their power of assimilating atmospheric nourishment. In respect of foliage we cannot certainly say that the wheat plant or the wheat crop when full grown, exposes a less surface to the air than full grown clover, but we know that the leaves of wheat, as of all our cereals, maintain their green color and succulence during a much shorter time than is true of clover. In case of winter grain the period of leaf-activity usually begins in October and ends shortly after heading out, in June, some weeks before the crop is harvested. Clover, on the other hand, is not arrested in its growth by any crisis of seed-production, but, when cut for hay, sends up new shoots, unfolds new leaves, and shortly yields an aftermath, its growth going on uninterruptedly all the summer and late into autumn, until checked by heavy frosts.

That the actual leaf surface of the clover crop, taking its duration into account, is much greater than that of the wheat crop, I do not doubt, because although the total weight of the harvested crops is, on the average, not very unlike when clover is cut for hay,* the total amount of vegetable matter organized is much greater in case of clover than in that of wheat, as appears from the table on page ninety-six, where clover roots are seen to constitue two-fifths (equal to six-fifteenths) of the entire plant, while the roots of rye, which doubtless do not differ much from those of wheat, are but one-fifteenth of the entireplant.

You see that the foliage and mode of life of these two classes of plants are very different for the purposes of gathering food from the atmosphere, and they must therefore be expected to leave the soil in a very different condition, because

* Corresponding crops are, according to

	Winter Wheat. Lbs. per acre.	*Clover.* Lbs. per acre.
E. Wolff,	6,230	5,340
Lippe-Weissenfeld,	5,760	6,330
Rohde,	4,270 to 6,400	3,480 to 5,230

their roots remain there, and the material of those roots is gathered very largely from the atmosphere; so that when we raise a grain crop we leave in the soil a small quantity of material taken from the air, but when we cultivate a deep-rooted plant which grows the season through, we leave a large amount of atmospheric matter in the soil.

Again, in ordinary culture some plants are permitted and required to reach a crisis of growth which others are not allowed to attain. This crisis is seed-production.

Our meadow grasses are of the same botanical order as the cereal grains; which means that all these plants are of the same great race and closely resemble each other in their most characteristic features. The noble wheat and the scoundrel quack are, in fact, brothers of the same family, both being of the genus Triticum. The latter is sometimes termed wheat-grass, as if in allusion to this brotherhood. There are two other grasses, vagabond members of the wheat family, living obscurely in this country. Barley and the oat have each two brothers of low degree—worthless grasses, living on salt or sandy shores, or on rocky hills, and unknown to the cultivator.

If wheat, instead of being allowed to ripen its seed, as is our universal practice, should be mown or fed off just before heading out, it would throw out new shoots and continue to grow the summer and autumn through, would come on the second year and deport itself as a perennial; would in fact, become grass in the usual sense of that word. Wheat is probably not hardy enough to make a good substitute for Timothy, but it is sufficiently so to justify our statement.

The reason why wheat under our culture is an annual is that the process of seeding exhausts the plant, and as a consequence it dies out naturally. It is the universal opinion among farmers that the meadow grasses are weakened very much by being allowed to go to seed. I have myself observed that where Timothy seed was raised the crop of grass the next year was very small, although the soil was excellent. The plants had suffered severely from being allowed to go to seed, notwithstanding Timothy has a bulbous root, which

should fortify it considerably against this strain, and a small seed, which renders the exhaustion less than is the case with our bread-grains. The production of seed is thus a critical thing for the life of the plant.

Let us consider again for a moment, the mode of growth of our cereal grains. Sown in the spring, the plant comes up and grows, slowly at first but with increasing vigor, up to the time of "heading out"—a period of two months. Then the growth acquires its greatest intensity. It heads out, blossoms, and the seeds begin to form and ripen, and this whole process of seed-production requires but about a month when the weather is favorable for its completion.

In actual trials with the oat plant, it has been found by Bretschneider and Arendt that a large share of the growth of the over-ground part of the plant occurs at the time of heading and blossom. Thus the former observed that out of 6,886 lbs. of the dry acreage yield of the oat, 3,099 lbs., or three-sevenths of the crop, were produced from June 19th to July 8th, i. e., in nineteen days; the total period of growth being one hundred and six days. Arendt found that three-eighths of the total dry produce of the oat grew in twelve days, 18th to 30th of June, the period of heading and bloom, and during the twenty-two days between June 18th and July 10th, nearly three-fifths of the growth took place. [How Crops Grow, p. 205, et seq.]

Before the seed is ripe the lower leaves begin to turn yellow, and show that their activity is diminishing or has ceased altogether, and the ripening of the plant takes place to a great extent, by the removal of matters which have been previously stored up in the stem, leaves and roots, into the seed. You may cut any of the grains at the root when the kernel is in the milk, and the seed will still ripen, and although, if you cut it too early, the kernel will shrink, it will be perfect in its parts and serviceable as seed-grain.

It thus appears that the cereal plant grows from the soil and atmosphere until the seed arrives at a certain stage of development, then the activity of the roots and foliage decreases, the acquisition of food from external sources gradu-

ally diminishes, until it ceases altogether, the plant concentrates all its energies upon the seed, all its juices flow thither, and the roots, as well as the leaves and stem, are exhausted in the effort. The seed grows, not directly at the expense of the soil and atmosphere, as the plant has done, but at the expense of the plant itself. It is, indeed, true in all cases that the seed is formed from the plant itself; but there are plants which, while feeding the seed from themselves, are still active in gathering food from external sources; and other plants, like the cereals, which do not, at the same time that they are elaborating seed, gather food from outside sufficiently to maintain their individual life.

In contrast with the cereals, look again at the clover plant. This starts from a seed, grows vigorously, buds, blossoms, forms seed, and the seed ripens; but there is not that uniformity in the time of budding, flowering and ripening of clover that is noticed with wheat. In a field of wheat, if the catch has been good and every thing is as it should be, when one head is ripe all the heads in the field, practically, are ripe. Every stem heads out, blossoms and ripens about the same time. In the case of clover, you have a much greater diversity, especially when the soil is rich and the plant grows thriftily. If the soil is poor, you will have a nearer approach to uniformity. When you are getting a large amount of foliage, you will find on the same plant ripe heads and buds. If you pick off the ripe heads the plant will still keep throwing out new buds. The process of flowering and ripening is a continuous one, and it does not affect the vigor of the plant to nearly the degree that happens to wheat. During all the period of the growth of the clover plant until the seeds are ripe, the roots are still active and the foliage still vigorous. The quantity of seed produced by the clover plant is much less, relatively to the weight of the plant, than the quantity of seed produced by the wheat plant, and the energies of the clover plant are relatively less occupied in ripening the seed than is the case with wheat.

You would therefore expect these very different plants to have a very different function in the rotation of crops.

An annual plant, again, one that is sown in the spring, or in the fall, perhaps, and is harvested within a year, other things being equal, will be different in its relation to the soil, from a biennial plant, which lives two years, or a perennial plant, which keeps along indefinitely. Now, our ordinary grains are annuals, as we cultivate them; the clover plant is a biennial more nearly than any thing else. When it grows vigorously, it is usually spent in about the second year. We may not call it properly a biennial in a botanical sense, but in an agricultural sense it is a two-year old plant. We cannot depend, ordinarily, upon having much clover from the sowing of 1872, later than 1874, except as the result of self-seeding. Our natural grasses are perennial; they live, we do not definitely know how long. Their mode of propagation, besides from seed, is by root-suckers; the old root dies, but in the meantime it has propagated a numerous family, which succeeds it, and the race is kept up without the trouble of sowing any seed or giving any attention to the matter at all. These distinctions make an obvious difference in the relation of the three kinds of plants to the subject of rotation of crops.

We have thus considered the plant itself, its roots, foliage, and manner of growth; now let us look more closely at what remains when the crop is removed. This matter came up incidentally, and a little out of order, yesterday, as I referred to the tables on the board. When I raise a crop and harvest it, I leave, of course, the roots in the soil, I leave the stubble on the surface. If each crop were taken out of the soil completely, root as well as branch, so that nothing of it were left in the field, the effect of any crop upon the soil would be measured simply by what we took away. But we leave a great deal in the soil. Ever since farming has been practised, the value of what is left on and in the soil has been, to some extent, appreciated, but we have not known accurately the quantities or the relative proportion of those substances. We have known that clover leaves much more than wheat, but the precise relation we have not understood as we understand it now, and we do not understand it now as we ought to and as we shall understand it after further investigation. I re-

ferred yesterday to the table of Dr. Weiske, of Proskau, which gives the ingredients of the stubble and roots of various crops remaining on and in an acre of land after harvest. (See page 95.) This is the first, or nearly the first, exact experiment of the kind that has ever been made, and these observations must be repeated here and there, on different soils, before we can get entirely trustworthy data, to enable us to make a satisfactory calculation. Still, these first results will serve a very good purpose.

In the case of rye, for instance, you have 3400 lbs. of dry vegetable matter remaining in the soil to the acre. Ordinary rye straw contains some fourteen per cent. of moisture. The vegetable matter in the table is considered free from that variable amount of water which is always present in the plant, unless it has been dried at the temperature of 212°. In the case of barley, we have about half as much as in rye—1515 lbs.; in oats, 2200 lbs.; in wheat, 2240 lbs.; in red clover, 6580 lbs.; in buckwheat, 1630 lbs., and so on. You see that in the amount of matter remaining in the soil, the clover crop far surpasses any other. If it were a fact that the organic vegetable matter of one crop remaining in the soil, supplies the food for the following crop, you see that what remains in the soil from a good clover crop would furnish the material for about three oat or wheat crops. It is not the fact, that the vegetable matter from one crop acts as such directly to support the succeeding crop; but it is a fact that some of the ingredients of the vegetable matter are of use to the succeeding crop, and in some places must be supplied, in order that the succeeding crop may grow. That is especially true of nitrogen. We have in the clover field a residue of 180 lbs. of nitrogen; in rye, we have 62 lbs.; in oats, 25 lbs.; in some other crops we have a larger quantity; you see how the figures run. (p. 95.) This nitrogen came partly from the atmosphere by the foliage, and partly from the soil taken up by the roots. The clover residues contain three times as much nitrogen as those of rye and 7 to 8 times as much as those of wheat, barley, or oats. We have 246 lbs. of lime remaining in the residue of clover—three times as much as in that of

any other crop. This, of course came from the soil. All these shallow-rooted plants, when they succeed clover, find ready to their hand, in the upper eight or ten inches of the soil, material brought up by the previous clover crop from twice that depth, or more. The clover not only furnishes to the succeeding crop these mineral matters that were in the upper portion of the soil, but it takes them up from a depth where they would not be directly accessible to other plants, and puts them where they are wanted. The clover plant leaves in the surface soil, as the table shows, a much larger quantity of all those materials than any other crop. The only apparent exception is that of soda, and soda is a substance which is not, as the best information we have upon the subject tends to show, essential to any cultivated plant. We have of magnesia, 46 lbs. in clover, against 14 in rye. Of potash, 77 lbs. in clover, against 30 lbs. in rye. Of sulphuric acid, we have 24 lbs. in the case of clover, against 12 in the case of rye. Of phosphoric acid, which is, on the whole, the most precious mineral substance in the soil, because it is the most costly when we have to supply it by purchase to our fields, we have 71 lbs. in the case of clover, against 24 lbs. in the case of rye.

Now, the point comes in here again to which I referred yesterday; namely, the ratio of root to top and of foliage to seed. In the rye crop, when ripe, I have nearly 14-15ths of the vegetable matter above ground, (and the same is probably true of all the grains,) and when I get off my crop, I get off 14-15ths of the whole. (See table, page 96.) Fourteen-fifteenths of the vegetable matter is carried away in my grain and chaff and straw, if I cut close to the ground. In the observations whose results are given in this table, there was no stubble. If I leave stubble on the ground, I reduce the proportion of removed substances. When I take off the clover plant close to the ground, for every fifteen pounds I take off, I leave ten pounds in the soil; whereas, in the case of rye, for every fourteen pounds I take off, I leave only one in the soil. That is a great difference. When I cut the grain crop low, I take it nearly all away; but when I mow off my clover hay, I leave two-thirds as much as I take. The

assertion which has been made, that the part of the clover crop remaining in the soil is as good as that which goes into the barn, finds its justification in these figures. They show with precision and in detail, what observing farmers have long vaguely known.

The reason of the truth of the old saying, that if you can start clover, you can grow anything, is thus apparent; and we know further, from observation, that the habits of the clover plant are such that we can often start on a course of improving the soil with that plant when we could not with what are commonly called our more valuable cereal grains. Some years ago, I was in East Windsor, in this state, and I was shown two fields, separated by a fence, one of which you would call perfectly barren and useless; on the other was a growth of red clover a foot high, which I was told by Mr. S. W. Bartlett of that place, had been brought up within twelve months by the application of a bushel or two of plaster to the acre and turning in some sheep. I believe there was no seed sown upon the field; the plaster alone brought the clover in. The plants were there in an undeveloped state, and I suppose the plaster, by furnishing sulphuric acid and lime, both of which are large ingredients in clover, supplied the two things, or the one thing, it may have been, which was necessary in order to give the clover a chance to live. On the other side of the fence, one or both of these substances was probably not present in sufficient quantity to develop the starveling clover plants and to start their deep roots into the soil; but with that start, there is no reason why that land could not be made agriculturally profitable. It could never be converted into such soil as the Genesee region or a western prairie, because the original constitution or strength was not there; but it was a soil which might, by judicious management, be improved, and brought up to a reasonable degree of fertility. It would be hopeless to undertake to reclaim any such field as that by the use of wheat grown for seed; it might be done by rye cut green, but it would be a much slower process than by clover. The fields in that neighborhood had been cropped with rye beyond the memory of the oldest inhabitant. The plan had

been to take off a crop of rye once in three years, getting about nine bushels to the acre, leaving the soil to itself the other two years. Three years of weathering, and atmospheric action on that soil, put it into a condition to make a rye crop of nine bushels to the acre. If that rye were turned under, instead of being cut off, so as to make the soil more retentive of moisture, it could be brought up; but the clover plant is adapted to do that thing much more rapidly than the rye plant.

We now come to an important question, viz., the possibility of continuing the same crop on a field indefinitely. Should you ask me if that can be done, I could answer both "Yes" and "No," and be equally right in each reply. There are quite a number of agricultural questions that can be answered in just that way. Instances can be brought up in which almost any crop has been grown continuously, without interruption, or with no more interruption than the nature of the plant requires, for a term of years—in many cases for a long period of time. I mentioned yesterday the experience of Mr. Lawes, who has grown wheat twenty-seven years in succession on the same soil, and, without any manure has got an average of 16 bushels to the acre; while with manure he has averaged 36 bushels to the acre. We know that tobacco can be raised year after year on the same soil, with the help of manure and thorough tillage. The same is true of onions, buckwheat, rye, in fact, I do not know of any crop that may not be grown in that way. And yet, "circumstances alter cases." Clover will not grow on this or that farm, or on this or that field, with such and such culture, to advantage, unless an interval is allowed between the crops. In some sections, you cannot grow rye without interruption, and anybody can find cases in which none of our crops will succeed, for several years in succession, or even succeed at all. These differences depend chiefly upon the soil, not upon the plant, and it is dangerous to make any sweeping or absolutely general statement where so variable a thing as the soil is concerned.

Clover is a plant which has often given farmers a great deal of trouble to grow year after year, or to cultivate in quick

succession. It is generally admitted as a rule of practice that there is, ordinarily, no profit in attempting to grow wheat two years, or, at the furthest, three years in succession on the same soil. It is admitted to be a good plan generally not to grow any crop more than two or three years in succession. Even our natural grasses are included in this rule, although in some particular localities they do well indefinitely. We have indeed natural meadows and pastures which are as old as the memory of man and just as good now, for aught that can be seen, as they ever were. But even in the case of natural pastures we know that "circumstances alter cases." Each farm, perhaps, may have some low-lying piece of moist land occasionally flooded by a river, where grass can be cut year after year, year after year. Then we have uplands which must be broken up once in a while; they get "hide-bound," and the grass runs out. These facts are familiar to you all, and illustrate the broad statement that there are some soils where the same crops can be cultivated for a succession of years and other soils on which rotation is quite indispensable. There are soils where clover has been grown once in three years for a very long period. I have in mind a valley in the Austrian Tyrol—the valley of Saint Martin—where this has been done. No one living can remember the time when this practice was not followed on certain parts of that valley. They have a marl which is regularly put upon the land, and by its use the clover crop continues undiminished from generation to generation. Its growth there is also very luxuriant, the ordinary clover stems being five or six feet in height. This is a very remarkable case of natural clover ground kept unexhausted by a native fertilizer. But the land of Mr. Lawes, adjoining the fields where he raised wheat without interruption for twenty-seven years, would not carry clover except at quite long intervals. Mr. Lawes made a series of experiments on this land, beginning in 1848 and going on until 1860, in which he applied stable dung, coleseed cake, super-phosphate of lime, sulphates of potash, soda, and magnesia, sulphate and muriate of ammonia, soot, and fresh burned lime, singly and in various combinations. The fol-

lowing is a sketch of the history of the crops obtained from four acres, divided into eighteen plats, during twelve years: 1848; sown to clover and barley, having been heavily manured the previous season and borne a large crop of Swedish turnips. 1849; manured with various applications. Three cuttings yielded at rate of from three and three-fourths to nearly five tons per acre. Seeded in fall to wheat. 1850; in spring clover-seed was sown on the young wheat. The wheat yield was at rate of twenty-seven to thirty-six bushels per acre. After harvest, the clover catch not being good, the land was plowed. 1851; after manuring again, clover-seed was drilled in, April 28; came up well and was cut in September. Best yield was at rate of one and one-third ton of hay. 1852; clover looked well in winter, but in March symptoms of failure became apparent in many of the plats; later it died out in patches, more or less, in all the plats, still on the whole a good plant remained, and two cuttings gave hay on best plats at rate of two and one-fourth to three tons per acre. 1853; plants stood fairly through the winter but nearly all died off in spring. Land was then plowed and fresh clover-seed drilled in; plants came up weak. There was no crop worth cutting in autumn and during winter nearly the whole died off. 1854; field was plowed and left fallow till September. After heavy manuring (twenty tons yard manure per acre on some portions, and 5,000 pounds quick-lime on others) clover-seed was drilled in October 10. Plants came up, but died off during winter. 1855; clover-seed drilled in April 14. Best crop was at rate of one and one-quarter ton of hay per acre. Plants died in winter. 1856 and 1857 land was left fallow. 1858; sown to barley without further manure; crop fifty-eight to sixty-five bushels per acre. 1859; without manuring, sowed to clover. Crop cut in September was one to one and one-half ton hay per acre. 1860; plant looked well through winter, but as spring advanced died off rapidly, and in June the few remaining plants had a stunted and unhealthy appearance.

Thus, after seven sowings and the liberal use of every fertilizing element, Mr. Lawes was compelled to see a complete

failure of the attempt to keep his land in clover. He relates that in the rotations customarily practised in his neighborhood, a good yield of clover can be relied upon once in six or eight years.

DR. RIGGS. The land was what they call "clover-sick."

PROF. JOHNSON. "Clover-sick," and finally clover-dead!

Mr. Lawes made another interesting trial on a piece of originally similar ground, which had, however, been used as a kitchen-garden probably for two or three centuries. It was sown to clover early in 1854, and from this one sowing the plant grew well, without further manure, for six years and yielded in that time fourteen cuttings, at the rate of twenty-six tons of hay per acre for the six years, or four and one-third tons yearly.

In discussing the causes of clover sickness, Mr. Lawes suggested that the assumption that clover requires a portion of food to be supplied by the soil in the form of certain organic compounds—vegetable matters or humus, such as are contained in garden earth and come from the yard manure, would perhaps explain why the crop failed on ordinary soil, but should succeed in a garden which had been heavily manured perhaps for centuries. Mr. Lawes did not assert that this was the reason, only that it *might* be.

But I think we have facts enough to justify us in concluding that that is *not* the reason. When a student in Germany, I saw an experiment by Dr. Wolff of the Academy at Hohenheim, which he was in the habit of making for the benefit of his classes. He took a quantity of rather poor soil, and calcined it in a clay muffle—a kind of oven which is heated by fire burning all around it, so that its sides are brought to a bright redness. This operation completely burned out all the organic matter of whatever kind that was originally in the soil. To that soil he added the various components of the ashes of plants which are given in the table page 78, viz.: lime, magnesia, potash, soda, phosphoric acid, etc., in proper proportions, together with a certain quantity of saltpetre—nitrate of potash—and in that soil he raised the most beautiful clover. You can grow anything to perfection in that

way. You do not need a particle of organic matter in the soil for the growth of any plant. Many plants have been grown in simple water in which the mineral elements of the plant, including nitrates, were dissolved or suspended.

The suggestion that the result, in the case to which Mr. Lawes refers, was due to the absence of vegetable matter, must therefore be regarded as destitute of foundation. I believe that if he had spaded his land as deep as the roots of clover go, and had fertilized it well to the same depth, he would have cured the clover-sickness effectually.

The weight of evidence goes to show that this "disease" is owing to the lack of nutritive material in the lower strata of soil, where the long clover-roots go, and where they must find nutriment. Those soils which are naturally adapted to clover are those in which an equivalent to deep manuring is created by the disintegration of the soil itself to a considerable depth.

Mr. Lyman. We have instances in this county where clover has grown for thirty years, in deep soil.

Mr. Gould. The soil of the Genesee wheat lands, where their regular practice has been, for seventy or eighty years, to alternate clover and wheat—wheat is their staple crop, and always has been, and they always prepare for it by a crop of clover—is what you would call a rich loam, mixed to a considerable depth with fragments of a slaty rock. This slaty rock decomposes so rapidly as to keep the soil constantly rich, and rich to a considerable depth. It does not decompose on the surface rapidly enough, so that they can get a wheat crop every year, but if they put on clover, and let its roots go down where there are materials which the roots of the wheat plant cannot reach, and bring those up to the surface, then their wheat crop runs right along, and if rust or insects do not interfere with it, they get a large yield every time they try it. They have two years of clover and one of wheat.

Prof. Johnson. Do they cut the clover entirely off?

Mr. Gould. They do, one year. They generally have a pretty good crop before they plow it in. They plow it in, usually, about the first of August.

Dr. Riggs. They take off the first crop, and plow in the second.

Prof. Johnson. There are some further facts in regard to clover which are very interesting. Dr. Voelcker, who has been Chemist to the Royal Agricultural Society of England for the last twelve years, when he was formerly in the Royal Agricultural College at Cirencester, found that some of the farmers in the vicinity not only thought that clover was an excellent preparation for wheat, but asserted that the wheat did better when, instead of plowing in the second crop, they took it off. The doctor we may suppose was rather incredulous; but he found other farmers who said, "Our wheat does best when we let the clover ripen, and save the seed, and put the wheat in after that." These opinions were put to him in such a way that he could but candidly say, "It would be folly to deny such statements on my knowledge of what is probable; I will look into the matter, and satisfy myself by my own trials. I am living here on the ground, and I can make the experiments, and if it be true, that taking off two crops of clover leaves the soil in better condition for wheat than when one crop is taken off, if I examine the soil when one crop has been taken off and when two crops have been taken off, I ought to find more available nitrogen and more available phosphoric acid in a given quantity of soil in the latter case than in the first case; and if it be true, that where the plant has been allowed to go to seed, the preparation for wheat is still better than in the other two cases, I ought to find still more of those materials." He made the investigation, and actually found that the quantity of those nutritive materials left in the surface-soil after the clover seed had been taken off was greater than when two crops of clover hay had been cut, and greater when two hay crops had been removed than when only one had been taken off. That is due to the fact, which I have already insisted upon, that the clover plant, after producing its seed, is still able, when the character of the soil is adapted to it, to continue its growth and bring up to the surface-soil those materials which the wheat plant cannot reach. We cannot, from cases of this sort deduce rules of universal

application, and this English experience may not apply to the Genesee valley or to the lands of this vicinity, because of differences of soil, but these results of Dr. Voelcker are of very great importance. They enable us to make the experience of those Cotswold farmers of general value, by showing us the reason of their result. They furnish us a grand contribution to our knowledge of the capacities of the clover plant. If the farmers of Genesee do not find the rule to hold good with them, we shall find, by study, the reason for it.

QUESTION. It is often asked, What is to be done with our side-hill pastures in New England, that are too rough and hard or too steep to plow and get manure on? I have a pasture of this kind. It is naturally moist land, pretty stony, and it has begun to be covered with moss. Forty years ago, one acre of it produced more feed than two do now. What shall I do with that land? It is considerably steep, and it would be very unprofitable to undertake to plow, manure, and cultivate it. I have been thinking of putting on a heavy harrow, well sharpened, with a strong team, in the month of March, when the ground is thawed say three or four inches deep, and harrow it severely, and then sowing clover. Can we not in that way resuscitate these old pastures, so that they will produce something again? If I can get some information on that point, it will be valuable to me, and I think I have neighbors who would receive benefit from it. We have immense quantities here in Windham county of moist side-hill land, too rough to plow and cultivate. What is to become of these pastures? Are they to become a loss to us?

MR. LOW. Travellers in the northern portion of this county will find a great many acres of that kind of land which are producing most luxuriant grass, the result of the application of plaster and ashes. You do not need clover seed if you put on ashes and plaster.

PROF. JOHNSON. There is one question to which Mr. Gold referred in a letter to me written previous to the one which I read yesterday, and that is, the waste of manure, which seems to belong to the production of some crops and not to others. Any man who for twenty-five years will cultivate a

number of plots of land with different crops and different fertilizers, will get hold of a great many facts and find a great many questions coming up which it would be exceedingly interesting to discuss. This is what Mr. Lawes has done. He has shown that on his land, in order to get a large crop of wheat, he must use a great deal of one kind of manure. I mentioned yesterday that he got 16 bushels of wheat to the acre, for twenty-seven years, in unbroken succession, on land to which he applied no manure whatever; that by the use of 14 tons of stable manure per acre, applied annually, he was able to get 36 bushels of wheat. By using all the elements of our fertilizers, with the single exception of nitrogen, applying phosphates, sulphates, and nitrates of lime, magnesia, potash, and soda, all the fertilizing matters which are found in ashes, in guano, or in stable dung, nitrogen compounds excepted, he raised the crop to barely 25 bushels; but when, to one good dose of these materials, he added annually 400 lbs. of salts of ammonia, or nitrate of soda, the yield went up to 36 bushels and held at that point for years. This difference between 25 and 36 was unquestionably due to the nitrogen of the nitrate of soda or salts of ammonia. If the facts admit of any other inference, I do not understand the logic which can make it.

Let us compare the quantities of nitrogen in those two applications. In the salts of ammonia, there were about 80 lbs. of nitrogen; in the barn-yard manure, Mr. Lawes says 200 lbs.; but there are usually nearer 300 lbs. of nitrogen in strong stable manure. It would thus appear that there must be a great loss of nitrogen, and the wheat crop has got the repute, among some writers, of wasting a great deal of nitrogen in its growth.

On another plot of land, where Mr. Lawes raised barley, he applied 200 lbs. of ammonia-salts, which contained 40 lbs. of nitrogen, and raised 48 bushels to the acre. When he doubled his dose, and put on 80 lbs. of nitrogen, his grain was so heavy that it lodged and failed to ripen, and the crop was spoiled. Without the addition of any fertilizer, the soil gave him considerably less than half that amount.

I will mention some other experiments which may give us light on this subject, made by Dr. Hellriegel, who has been studying agricultural problems for some twenty years, having been all this time employed in one of the Experiment Stations kept up in Germany, partly by government and partly by associations of individuals, for the purpose of making agricultural investigations, by the help of chemistry and physiology, and whatever aids can be brought to bear on these questions. Dr. Hellriegel proposed to himself to ascertain what quantities of the different materials which plants require for their growth must be furnished to them in order to get a crop. We have for some years known that phosphates and sulphates of potash, lime, and magnesia, and nitrogen must be given, but we need to know how much of each of these various substances is necessary. In order to arrive at accurate results, Dr. Hellriegel had to experiment under artificial conditions. So he took for soil a perfectly pure sand, or one as nearly free from everything that would furnish plant-food as possible. In a large series of experiments, he mixed the soil with a sufficient quantity of all the materials necessary for the support of a crop, with in each case one single and different exception. These excepted substances he added in graduated quantities, putting one quantity in one box of soil and a larger in another, and so on through a sub-series of eight or nine boxes, in order to ascertain by the growth of the plant, in which case he had hit the best proportion of these ingredients. His trials have been extended to the whole list of the elements of the plant. In regard to water, for example, he found that the growth was greatly influenced by the quantity of this substance with which the crop was supplied. There was a certain quantity of water in the soil necessary to a maximum crop, other things being equal. In the sandy soil which he experimented with, the largest yield of rye, wheat, or oats was obtained when the soil held steadily ten or fifteen per cent. of its weight of water. On increasing this proportion, the straw in some cases was heavier, but the grain was reduced in quantity. Thus the very fact that the amount of rain fall is unequal in absolute quantity, and unequal in

distribution from year to year, is of itself a reason why you get different crops, everything else remaining perfectly the same. That is a matter always to be taken into consideration in judging of the value or effects of a fertilizer. But it is the effect of nitrogen I am coming at. Dr. Hellriegel experimented with various quantities of nitrogen (in the form of nitrates,) applied also to cereals. The plants grew in the artificial soil, consisting of pure sand, with an admixture of ash ingredients, in such proportions as previous trials had demonstrated to be appropriate. All the conditions of the experiments were made as nearly alike as possible, except as regards the amount of nitrogen, which in a series of eight trials ranged from nothing to eighty-four parts in a million parts of soil. The following table gives the results.*

Effect of various Proportions of Assimilable Nitrogen in the Soil.

Nitrogen in 1,000,000 lbs. of soil.	Yield of grain in lbs.		
	Wheat.	Rye.	Oats.
0	0.0	0.2	0.8
7	0.5	0.8	0.9
14	1.7	1.9	2.6
21	2.7	2.6	3.8
28	3.7	4.2	6.2
42	6.1	5.1	7.0
56	7.2	7.1	9.0
84	9.2	8.7	9.3

The maximum crops of wheat and rye were obtained with eighty-four parts of nitrogen to one million parts of this soil, but the maximum oat crop was got with fifty-six parts of nitrogen, at least; the gain between fifty-six and eighty-four parts of nitrogen, in the case of oats, was a mere trifle. Dr. Hellriegel made some other observations, which he has not reported in detail, which led him to conclude that he might have got his best crop of wheat with seventy parts of nitrogen, his best crop of rye with sixty-three parts, and his best crop of oats with fifty-six parts, to a million parts of soil. This

* See also "How Crops Feed," p. 268.

soil which he used was not a large absorbent or fixer of the substances furnished to the plant. The nitrogen which he used was in the form of nitrates, which are never absorbed by soils, so far as we know. The matters with which he enriched the sand, therefore, were soluble and entirely available to the plant. The latter had only to stretch out its roots to obtain its food, and the quantity of soil was small, so that the roots had not far to travel, and could so completely occupy the soil as to come in contact with all the nourishment it contained.

QUESTION. Does nitrogen form a part of the plant?

PROF. JOHNSON. Yes; an important part, always.

QUESTION. How large a part?

PROF. JOHNSON. In the entire plant, when dry, from one-half to two per cent. In the different parts of plants it varies greatly. You have fifteen per cent. of nitrogen, for example, in the gluten of wheat; one and one-half to two per cent. in the wheat grain; you have no nitrogen whatever in pure cotton fiber; there is no nitrogen in the sugar or in the starch of the plant.

QUESTION. Does it exist in the wood in the form of nitrate?

PROF. JOHNSON. No; but in the form of what is called albuminoids; something which is similar to the albumen or white of the eggs of animals.*

MR. S. L. GOODALE, of Saco, Maine. What is the comparative value of a given amount of nitrogen in ammonia salts and in animal substances, such as blood, flesh, dung?

PROF. JOHNSON. It is very difficult to say; but these experiments of Mr. Lawes show that in order to get thirty-six bushels of wheat to the acre, he used two hundred pounds of nitrogen, in the form of stable manure, whereas eighty pounds of nitrogen, used in the shape of salts of ammonia, gave the same crop. The reason of that is, that the nitrogen of the salts of ammonia is in a condition to be made immediately available to the plant, whereas the nitrogen in animal

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* See "How Crops Grow," pages 94 to 109.

manure exists in a form or in forms such that much of it cannot be taken up by the plant at once, if at all. It must undergo an alteration to become of use, and much of it, instead of passing into an available condition, doubtless becomes permanently inert.

MR. S. L. GOODALE, of Saco, Maine. What are the circumstances under which the nitrogen of manure is converted into ammonia, which is retained in the soil, and what the circumstances in which it is converted into nitrates, which may pass out of the soil?

PROF. JOHNSON. So far as can be judged from our imperfect knowledge, a rapid decay of nitrogenous matter which goes on with comparative exclusion of air, generates ammonia; on the other hand, where there is a large access of air, there we have nitrates formed. But we do not know minutely the conditions under which nitrates are produced. Another fact to be noticed is this: that in the decay of animal matters with access of air, there is invariably a quantity, and often a large quantity, of nitrogen liberated in the state of free, gaseous nitrogen, such as exists in the air about us, and which does not assume the form either of ammonia or nitrates, and thus becomes lost as a fertilizer.

MR. GOULD. Before the current of questions drifts away from the main subject of the lecture, I am desirous of asking the Professor a question as matter of explanation. He has stated a distinction among plants—plants which exhaust the nitrogen and plants which accumulate nitrogen, in the soil. This is a subject of immense practical importance, and I think it will play a much greater part in questions of practical farming, than it ever has done in the past. The statement which he made would justify the inference, although he did not state it himself, that plants accumulate nitrogen in the soil in proportion to the surface of their foliage extended to the air, and to the length of time during which that foliage is in actual growth. The inference would be that there was a proportion between the amount of accumulation and the length of time. I desire to know whether the Professor wishes to be understood in that way?

PROF. JOHNSON. I would not assert that to be the fact, absolutely or unqualifiedly, but the indications very strongly favor that general conclusion.

MR. GOULD. That is my own personal impression. I wished to know whether the Professor so understood it.

PROF. JOHNSON. I was about to say how much nitrogen was needed in the soil.

A wheat crop of thirty-three bushels, with straw and chaff, contains fifty-six pounds of nitrogen. If we allow for stubble and roots one-fifth this quantity, we have for the total nitrogen required in the vegetation of an acre of wheat, say sixty-eight pounds.* Hellbriegel found, by actual trial, seventy pounds of nitrogen to be sufficient to produce his maximum wheat crop.

Mr. Lawes' soil furnished enough nitrogen to yield seventeen bushels of wheat. Addition of forty-one pounds of nitrogen, in form of ammonia salts, gave twenty-seven bushels, or an increase of ten bushels. Eighty-two pounds of nitrogen applied in the same form gave thirty-seven bushels, or twenty bushels increase.

The reason why Mr. Lawes was obliged to add eighty-two pounds of nitrogen to double the wheat crop, lies in the following considerations:

When ammonia is applied as manure, a portion of it is fixed in a comparatively insoluble condition in a clayey or loamy soil, and a share of this fixed ammonia it is doubtless very difficult for the plant to acquire. Again, nitrification,

* On examination of wheat roots collected by Schubart June 8th, 1855, Stockhardt found that the roots composed a little more than one-fifth of the entire plant, or twenty-two per cent., and the nitrogen of the roots was a little less than one-fifth that of the entire plant, or eighteen per cent.

Heiden found the nitrogen of the roots of ripe rye but one-tenth that of the entire nitrogen. Stockhardt's examination was made on the *unripe* wheat. By ripening, the proportion would doubtless have been reduced. Heiden found, in fact, that the ratio of root to top in blossoming rye was about one to six, but in ripening was reduced to one to thirteen and one-half.

If, then, the roots alone contain one tenth of the entire nitrogen, the roots and stubble may be fairly reckoned to contain one fifth of the entire nitrogen.

Weiske, indeed, gives twenty-two pounds of nitrogen per acre for the *roots and stubble* of wheat, but we are not informed how high the stubble was cut.

or conversion of ammonia into nitrates, goes on, and the nitrates are freely soluble and wash out of the soil. Then we know that the roots of the plant cannot come into contact with the whole of the soil, so that we should not expect that all the available nitrogen there would be taken up. The figures show that from seventy to eighty pounds is sufficient, provided it is in a form and in a position in which the plant can appropriate it. In stable manure we appear to waste a considerable quantity simply because it is not present in a form in which the plant can use it.

Now, stable manure, when it is put into the soil, may be compared with clover roots or any other vegetable matter put into the soil. Stable manure consists very largely of vegetable matter which has passed through animals, and of more or less litter which we mix with it. There is a small portion of the nitrogen of the manure actually formed into these ammonia salts which Mr. Lawes applied, but most of the nitrogen, in order to be used by the plant, must be transformed, must pass into some other state than that in which it exists in the manure itself; must probably either be converted into ammonia or nitrates.

Mr. Lyman. Suppose the case that I wish to use all the liquids of my stock, and absorb it all, and do not pay so much attention to the coarser manure. What, in your judgment, is the relative value of the one placed by the side of the other? This question is being agitated extensively.

Prof. Johnson. That depends somewhat upon the food which the animals have. If they are kept upon low rations the liquids would be the best. But if they are supplied with rich food, grain, meal or oil-cake, that indeed increases the value of the liquids, but increases more, relatively, the value of the solids, because you cannot get into the circulation of the animal beyond a certain amount of nutritive matter; but you can run through the intestinal canal much more material which is only partially digested, and so the value of the solid manures, as compared with the liquids, is increased by increasing the richness of the food.

When oxen or other herbivorous animals are kept on ra-

tions which just maintain them without much gain or loss of live weight, the daily urine usually contains rather more nitrogen than the dung. Sometimes the nitrogen of the dung exceeds that of the urine, but while all the nitrogen of the urine is adapted for immediate use as plant food, much of that in the dung is comparatively inert. The urine contains also more alkalies than the dung, but the dung usually contains all the phosphoric acid and most of the lime.

Measured by assimilable nitrogen or by alkalies, the liquids are much the best; measured by phosphates, the dung is most valuable. Practically, however, we cannot make a sharp separation. The solids nearly always absorb a good portion of the liquids.

I think I have now gone over about the ground that I contemplated. At least, we have approached pretty near the hour for dinner. With regard to the question about the improvement of pastures, there are a variety of ways in which the land can be saved from being useless. One of the most practical methods is to put on a top-dressing of some sort. The fact that moss grows there indicates that the soil is getting a little too moist, and it is a question whether plants will do well unless that moist condition of the soil is somewhat broken up. If those fields admitted of under-drainage, and it did not cost too much, that would be an effectual remedy against moss; you would never see that again. My excellent friend, Mr. Blakeslee, whispers to me, "Put on a flock of sheep!" and that is also an excellent prescription.

MR. ——. We can't do it; the dogs kill them.

PROF. JOHNSON. The treatment which the gentleman suggests who asked the question, has nothing against it theoretically, and the fact that it has succeeded elsewhere shows it must be a good plan. There is no reason why such land should not grow into great value. If clover could be brought in it would probably raise the land in a couple of years to the productiveness that it had forty years ago, by simply bringing up the materials which the roots of other plants cannot get at. Probably any application containing lime or sulphate of lime, leached ashes, oyster-shell lime, or any thing of that

sort, would be beneficial. These things always favor the growth of clover.

MR. LOW. I have found the results of the application of commercial fertilizers so variable, under different circumstances, that I would like to have the Professor give us some information on the question whether, if we should incorporate with any litter or straw we have about our farm yards some chemicals that would act upon the soil something like barnyard manure that would not be better than the chemicals alone.

PROF. JOHNSON. I do not know of any chemicals, except, perhaps, plaster, that can be advantageously mixed with the yard litter.

AFTERNOON SESSION.

The Board reassembled at two o'clock, Vice-President HYDE in the chair,

The subject upon the programme was

TOBACCO,

and the discussion was opened by Dr. Riggs, of Hartford.

DR. RIGGS. I presume there are many men in the convention who know more about raising tobacco than I do; still, I will give what little information I have in regard to it if you will accept it. I shall have to confine myself to tobacco as raised in Connecticut—to the wrapper, rather than the general subject.

The soil best adapted to it, so far as my observation extends, is a light, sandy loam, well pulverized. Even our sand-blows in East Hartford have been converted into good tobacco fields. Our next best land is what I shall call, not alluvial soil, such as our river bottoms, where the water overflows and sometimes destroys the crop upon them, but like the

level lands near Springfield, that are not overflowed. The finest leaf tobacco, the most desired, the most sought for, is produced on that quality of soil which I first named. But there are other soils, good loams, that lie higher up, that produce good qualities of leaf by being properly fertilized.

The great question with us is, how we shall get manure to raise so much tobacco and to raise our other crops. It is exceedingly high, and we can hardly get enough for the general purposes of the farm, if we raise much tobacco. My plan has been to make all the manure that I possibly could make by keeping cattle and housing the manure in barn cellars, as we call them; and by fixing all the ammonia that is liable to float off, and saving that in the stables or in the barn-cellars, where it is somewhat warm and does not freeze. The mode of fixing that is simply the earth-closet system, which I have practised for fifteen years, and which is now just coming into vogue in houses. I make a practice of getting muck or light, sandy loam, even clay loam, wherever I can get it, in the fall of the year before the fall rains come on, I spend several days in carting that material, sods and soil down, a foot or two in depth, just as I can light upon it, sometimes in the highways, sometimes in the field. This I cart back of my cow stable, and make a pile six or eight feet in breadth, and it is so sustained by joists that I can pile it up five feet deep. This is sprinkled in back of the cows every day, after the stables are cleansed, and liberally distributed there, so as to absorb all the urine that passes down through. I have what is called in England, "boarded floors," that is, a two-inch plank, running lengthwise like a gutter, back of the cattle, three inches wide with a space then of two inches. Most of the manure made by the cattle goes down through. The urine runs off from where the cows stand and runs down through. I formerly had the floors all boarded in this way under the cattle, but they never got used to it; they were timid and would not lie down upon it. I thought it would take off the flesh of the cattle and therefore I have substituted lattice-work back of the cattle. The stables are cleaned twice a day, and the droppings mixed with this earth, and it deodorizes the whole body of the manure. There is no effluvia comes up

through. You would hardly know there were any cows in the barn, and yet there are twelve or fifteen on that floor. This earth, after it is put in, continues to dry until it gets quite dry, so much so that if there is a knot hole or crevice in a board it will sift out by a little jarring. In that way the urine is absorbed and the ammonia fixed and retained.

There is but little or no escape of the ammonia, which would otherwise go off by fermentation in such a cellar as mine, where it does not freeze. The pigs underneath—some half dozen or a dozen, depending upon the season—are continually working this over. They are fed there, their beds are there, and they are in there continually. The windows are quite large, and in the milder weather they are open, giving them plenty of light and air. Their beds are in one corner away from the cattle, made of straw and other material that we throw in on purpose for them to have a dry place to lie on. The pigs root over the manure and pack it down, which is very important in keeping manure well. They pack it down hard and tight, so that we are able to get twice the quantity in there that we should if we had no pigs there. I keep five horses and their manure also is thrown in among the pigs, so that the horse and cattle manure and the absorbents are all together, and in the spring of the year the pen is so filled up that the backs of the pigs touch the joists above.

Then my other sources for manure are green crops. I have been long in the habit of plowing in rye for tobacco, and although my neighbors laughed at the idea exceedingly, it seems by the figures upon the blackboard that I have hit upon the next best plant, if not the best, for that purpose. As soon as the tobacco crop is off, I plow up the ground lightly with a pair of horses, and sow about a bushel and a quarter of rye to the acre. That comes up and gets a good start before winter, and in the spring, when I want to plow for tobacco, it is four or five inches high, depending greatly upon the earliness of the season, etc. There is plenty of manure. We have what we call a smoothing iron; it is made of two-inch plank, five feet square, spiked with railroad spikes on to joists, three inches by four. The end of it is made of

plank beveled so as not to carry the earth with it, and two or three weeks before planting out, this is drawn over the grain to level it and get it out of the way, and then I go on with the plow and turn it all deeply in. I have been in the habit of fertilizing the field with three hundred weight of Peruvian guano to the acre, and turning that in with the rye. The whole field is gone over in that way; plowed up to the depth of twelve inches as nearly as possible, and then we let it rest right there, that this vegetable matter may heat and go through its fermentation and whatever changes nature effects. When we get ready to prepare the ground we generally top-dress with perhaps a third of the quantity of barnyard manure that I should put on if I had not fertilized the piece with the rye and guano. We generally put on about four hundred weight more of guano with this manure and harrow it in thoroughly, and as soon as we have gone over it in that way, we put on the smoothing-iron again, and go right over the whole of it, levelling everything down smooth—ironing it, so that it is just as smooth as a floor, or nearly so. Then we let that rest a few days, until we think the manure and the guano have been completely absorbed and incorporated with the soil, so that none of it shall be lost. The great object of going over the field with this smoothing-iron is to pack it, and bring the manure in contact with the soil as much as we can, so as to have no escape of the ammonia. When we get ready to set the plants, we mark out the field the way we want the rows, which is generally east and west on our lot, because it inclines to the east. We take a light plow and throw a furrow this way and the other, turning the two furrows together. That is the preparation of the soil, with the exception that in some cases if there are any lumps, or the soil is not well pulverized, we go over the field and make hills so as to be sure to have nothing in the way of the man's progress when he undertakes to set his plants. There is an important point in raising tobacco. Many men set out their plants so carelessly that they topple right over, and make a kind of bow. Those plants will show themselves by not growing at all, in the course of a few days. Latterly, I have

not been in the habit of putting any phosphates in the hill. I put everything on broadcast, mix it up well, and turn two furrows together. My rule is to plant on those ridges; from twenty-two to twenty-four inches apart, and the rows three and one-half feet apart. My great error, in the first place, was in not setting the plants far enough apart. When the tobacco leaves grow from thirty-five to forty inches in length, and from twenty to twenty-four inches broad, they fill the field pretty thick, and it is impossible to get through the field to worm it, to sucker it, to top it, and to go through the various processes we have to put it through.

When the plants get up to a certain height, I have adopted a new plan in regard to the lower leaves. I found by close examination that the lower leaves of my plants, where they grow so large, were of very little value. I found they were dirty, torn, and a great many of them broken off, and when the spearer went through them and strung them, if he strung them by the leaves entirely, he would generally break off several more of them. I am in the habit of stripping off these lower leaves, when the plant gets up to a certain height, as useless leaves. If they are left on the plant they consume a good deal of nutriment which, if they were not there, would pass up the stem, and give me bigger leaves and more of them. I take off from two to three leaves, in order to enable the man who hoes to go along without being obliged to stoop and hold up those leaves. They are large leaves, but they really come to nothing, and when we get the hoeing done those leaves are out of the way and the plant seems to grow more rapidly above, because it has not to supply those lower leaves with nutriment.

The point of time to top tobacco, or the height to which it should be done, is very difficult to be described. The most general rule I can adopt or describe to you, is this: top down to a good leaf; and if the color of the plant is yellow above, be sure to cut down plump to a good leaf. We are apt to top too high. I tried an experiment upon my field, at the suggestion of some tobacco raisers. About a quarter of an acre was topped some two leaves higher than I usually top. They

said, "there is force enough in this ground to carry them along without topping, and you will have more weight." I heard to them, and let my men top high. I am satisfied it was a mistake, and those who are stripping the tobacco for me say that that tobacco is not as good in leaf and the top leaves are not really A No. 1, which they should be on any plant which has been properly raised. That is an important point. You have to decide upon a certain medium betwixt the bottom and top of the plant, for the better leaves of your tobacco. The lower three or four leaves I find worthless. They are all mangled, the worms get on them from the ground, and bore holes through them. Since I adopted this practice I have talked with a Virginia gentleman, who told me that it is the universal practice in Virginia to take off the lower leaves when their plants are growing, and they grow for plug and smoking purposes.

When the plant gets to a certain point and the suckers begin to show, we have to go through the field every few days and take off the suckers; and if there are any secondary shoots from the root, those are to be taken off. Sometimes a plant will divide at the bottom, and these shoots have to be pulled up. We pull them up and snap off the suckers, for they break very easily. The plants must be kept clear of them, and that throws the juice into the leaves, and they grow up much larger and longer.

It is almost impossible to say how many leaves should be left on the plant. I should say from eight to ten in the most fertile fields, and less in a crop that does not grow heavily.

QUESTION.—Do you wait until the plant is fairly in blossom before you top?

DR. RIGGS.—No, sir. There will be occasionally a stalk a little ahead of the rest that will show a blossom. We let them be until the blossom-buds round out and begin to appear. We are not particular whether we wait until they fully appear or not. When we go into a field to top it the man walks between two rows, and he knows, by a glance of the eye, when a row wants topping all the way through, and takes hold and snaps off the top and throws it down, first on one side and

then on the other, and if the shoots have not begun to branch very much, it makes no difference; he tops where he thinks the plant ought to be topped. Occasionally there will be a plant that will not be up high enough to top, and that he lets remain, and when it gets a proper height, as we go through the field to kill the large green worms that infest the plants, we top the balance, or go through on purpose, if the ground is not infested with worms.

The plant after that requires little care until it reaches the point for cutting. When it reaches a certain stage, (and we generally detect that stage by going into the field, say at eleven o'clock in the day, and bending a leaf betwixt the thumb and finger,) if it makes a snapping noise and cracks open it is ripe; if, on the other hand, it bends very much like a piece of India rubber, and only makes a crease, like drawing the back of a knife across a leaf, it is not ready to be cut. Some plants may be a little earlier than others, of course, if they are more forward; but in a piece evenly cultivated and pretty well prepared, well set with good plants, and all growing from the first, the piece will be very even in its time of ripening, so that it may be all cut at once. If we should leave a few plants in a row they would not grow enough better to pay for the trouble of cutting them separately.

We cut differently from what we used to. We used to cut in the morning after the dew was off, sometimes with a hatchet, sometimes with a saw. A saw is the best. If your tobacco is rank, and the leaves full of sap, a blow with the hatchet is very apt to tear the leaves. The man takes a common fine-toothed saw, seizes hold of the plant about a third of the way up, and cuts it off. A skillful man will cut it off with one cut. The first push of the saw will take the plant off, no matter how large it is. He lays that right back on to the side of the row carefully with a kind of sweeping motion, so as not to break the leaves, seizes another and cuts that in the same way. These plants are not allowed to remain there long enough to heat very much. We have adopted a new plan. We find that the quicker we can get the tobacco in the barn, away from the sun and light, the better the color of the leaf,

and the more lively and better the quality of the tobacco. If it remains long in the field the rays of the sun scorch it, which detracts materially from the value of the leaves. Two men go forward with a properly rigged wagon, and we have a "horse," as we call it, for sticking. A lath is stuck into a socket, a knife or spear put upon it, and the plants are handed by one man to another about as fast as the other man can put them on—from four to six plants to a lath—depending upon the size of your crop. Mine admitted only five this year.

QUESTION.—What is the length of the lath?

DR. RIGGS.—Four feet. Mr. Marston, in Hartford, a lumber dealer, who owns a mill, has laths sawed on purpose. They are a little thicker than ordinary laths for plastering. As the five plants are put upon the lath, another man takes it and carries it right to the cart, and pushes it on to the frame-work, slipping it along at right-angles with the body. There is a frame-work made on purpose, nearly four feet broad, and it slips on them so that the tops of the leaves just touch, or do not quite touch, the bottom of the wagon. They are pressed forward from time to time until they have packed on all they can get upon the two-horse wagon or cart. You may make the frame-work as long as you please, if you can get it into the barn. The wagon is drawn right to the barn, the two men following, and there the tobacco is placed upon the laths not more than from eight to ten inches apart, so that the plants crowd upon each other considerably. Commonly they are placed farther apart, but with my method of ventilation I can place them a good deal nearer. The whole field is then gone through with in that way. When we have cut all we can dispose of that day, the men go to the barn and begin to pass it to the roof, that is, to the upper tiers. My barns are so constructed as to take in four tiers four and a half feet in height, with one tier in the roof. They put that day's work overhead, and the next day's work is carried in and put on the lower poles, to get as much into the barn as possible. The doors are shut, the ventilators opened, and they go on in that way, putting up at night or early in the morning the tobacco they got the day before, and in that way the work is carried

on until we get it all into the barn. Any stray leaves that are worth picking up around the field are picked up by a boy, wound with twine, and hung up on poles around the barn, to cure as well as they may. They do not amount to much, however.

[The doctor then gave an elaborate description of his tobacco shed, the distinguishing feature of which consists in the method of ventilation adopted. The shed is raised about a foot from the ground, which, of course, gives a free circulation of air underneath, and what is known as a monitor roof extends the whole length of the building.]

REV. MR. COTTLE, of Pomfret. There is a great deal of tobacco raised in this State, and a great deal consumed. The question is how to have it consumed in such a way as to promote the moral, intellectual and physical development of the race. In other words, how we can best teach little boys and girls to use it so as to make better men and women of them.

DR. RIGGS. I find that there is a draft in this shed which carries off all the fog, and if there is a breath of air stirring outside, the tobacco will be sure to get it. It keeps the tips of the tobacco waving backward and forward, and every portion of the shed is ventilated from bottom to top. Very little side ventilation is necessary. Formerly the top of my tobacco would grow black, but I have had no difficulty in that respect in this shed. In this way we get a continual current of air. Not a breath can stir without taking up a certain quantity of this effete, dead air, from the tobacco, and carrying it off, and when your tobacco is well cured, all you have to do is to drop the boards on the sides of this monitor roof. Our tobacco was more uniform in this building this year than it ever was before.

Many of our farmers build their tobacco-sheds with one ventilator on top six or eight feet square; some will have two, one on one end and the other on the other; but this is by all means the best method. The ventilation is so perfect that you will hardly notice any effluvia or stench in the atmosphere, as is generally the case when curing tobacco in the ordinary way.

QUESTION. The ventilator runs from end to end?

DR. RIGGS. From end to end, right on the ridge-pole of the barn.

MR. GOULD. How broad are the dropping boards?

DR. RIGGS. Not less than a foot, and from that to eighteen inches, depending on the size of your building; sixteen feet long, each one with four strap hinges on it.

MR. LOW. If you were building a common barn would you adopt that plan?

DR. RIGGS. I should not recommend drying tobacco where hay was kept. I don't think animals take to tobacco.

MR. GOULD. How do you know when the tobacco is thoroughly cured?

DR. RIGGS. It will begin to dry, generally, at the top, and dry along up. You will see the change.

MR. GOULD. Is it cured when it is thoroughly dried?

DR. RIGGS. It will change color a little, but it will change more if you have plenty of light. The more sun and air and light you can have the lighter and less lively the color will be. It wants to be cured just as our old-fashioned mothers cured herbs. They picked their herbs in the fields and dried them in bunches put in dark closets, and hung them up nicely after they were cured, and when they took them out, the plants looked as green as the day they were cut. But tobacco changes to all sorts of hues, from a bright cinnamon color to a bleached and pale leaf.

MR. GOULD. Is it not a mere matter of fancy?

DR. RIGGS. There is a fashion among tobacco purchasers just as there is in the selection of stones. Some years they will find fault because the leaf is too light, and at other times they will find fault because it is too dark. You cannot very well control that except by non-exposure to light and air.

MR. LYMAN. Don't you know that that is an argument used by speculators to bring down the price?

DR. RIGGS. Oh, yes. "There are tricks in all trades but ours."

MR. LYMAN. I have been told that horses will eat tobacco with great avidity.

DR. RIGGS. My men strip the tobacco right at my horses' heads, and I see them every day offer it to my horses, but I do not see them take it.

MR. LYMAN. I do not mean when it is cured, I mean in the green state. Give them some green leaves next summer and see.

DR. RIGGS. It is very possible. I never experimented in that line.

MR. HUBBARD. Have you ever been seriously troubled with the cut-worm, shortly after the tobacco is set out? I did not know but your practice of plowing in green crops might save you from that pest.

DR. RIGGS. It does in a great measure. They will work on this green stuff underneath until the tobacco is out of the way, or until they have run their course. We were so little troubled with them last season that we hardly had to reset a plant. Some years we are troubled a little more than others, but we have noticed that since we have plowed in the rye we have been troubled less than formerly.

MR. HUBBARD. Can you give any explanation of the prevalence of white veins in tobacco, which are very objectionable to dealers, and destroy the value of the crop, almost?

DR. RIGGS. That is a fanciful objection rather than a real one. When they can operate in that way upon the raiser, they do so. But I cannot account for those white veins. Some growths will be thicker than others, and will have those white veins, especially when the plant is growing very rank and heavy. Perhaps it may be owing to the use of certain kinds of manure, as, for instance, hog manure. Hog manure produces a pretty thick leaf with us, and the color of it is rather a dark hue, approaching to black. We can only use swine manure as it is mixed with the other. We make them the instruments of turning it over and manipulating it in the barn cellar or in the pen. I never heard any one account for those white veins. We have never been troubled much with them, except in the case of a great growth of tobacco several years ago, where we put on an immense quantity of manure. Then we were troubled with white veins somewhat, and the

tobacco men who looked at it said, "Oh, white veins!" But those leaves were so large that they did not need to cut through the veins to get a cover for the cigar.

MR. HART. How many pounds do you raise to the acre?

DR. RIGGS. We think two thousand pounds to the acre a good crop. I have raised from two thousand two hundred to two thousand four hundred pounds to the acre, by actual measurement. I do not speak at random, as farmers do sometimes when they say they plowed eight or ten inches deep, and if you put on the rule you will find that it is four inches. There are not many who measure down on the land side of the plow. It is very indefinite. There are not many farmers who plow more than five inches deep when you come right to it and put on your rule. When you put on your rule and find twelve inches, you have a very large furrow; there is a large amount of earth turned up. It looks tremendous. It requires three yoke of oxen in ordinary ground, with a double Michigan plow, or any other, to go to such a depth as that and turn it over. I use a double Michigan plow entirely in the preparation of my ground for tobacco, on stubble land, turf land, corn land, and almost every thing but oats after corn. I am sometimes tempted, when hard pushed for time, to take my Collins' steel plow, which is the next best plow I use, going from eight to ten inches, by measurement. I would suggest, while on this point, to every member present, that he carry a rule in his pocket and measure the depth to which he plows, so as to have a little more definite information about it. I do, invariably, and when I say a foot I mean a foot, when I say fourteen inches I mean fourteen inches.

When I bought my farm the old furrow marks on the land were not over four inches deep, and for a very good reason. The former owner was one of those men who skin their land, —take two dollars off a field and carry it to the city and sell it for a dollar, put that dollar in their pocket, and think they are growing rich. I plowed those fields with a double Michigan plow, until I got down eight, ten and twelve inches. Now I have acres of that farm in herd's-grass and red-top of

great growth, and making a most beautiful kind of soil. That, however, is a digression from the subject.

MR. HART. After you have raised your two thousand pounds to the acre in the manner you have described, what do you get for it? What does it cost and what do you get for it? What is the net result?

DR. RIGGS. I cannot tell you what it costs me to produce an acre of tobacco. I ought to be a little abashed by it, too, for I have not yet kept an accurate account of the labor, as I should. I raise all the way from one acre to four. I have increased my number of acres in tobacco every year, and expect to increase them this next year. I cannot tell the relative cost. The labor required is perhaps three times as much as is necessary to raise a crop of corn, and hoe it twice.

QUESTION. Have you ever raised any tobacco on turf land, turned over in the fall?

DR. RIGGS. I have raised it so, but I generally turn it in the spring. I believe fully in the value of the fermentation of the sod, not only for tobacco but for corn; and I am led to that belief by some experiments tried by a neighbor of mine who is a pretty exact sort of a man. He told me that if a man would plow his fields in the fall for nothing (and his land is a medium clay loam), and charge him for it in the spring, he would rather have it done in the spring. He gave me his reasons, which were these. A neighbor of his bought a tract of ground and commenced plowing it in the fall. He intended to plant it to corn, and plowed about half of it in the fall, was taken sick, and died. The former owner agreed to take it back (as the man had not paid for it entirely), and did so. In the spring he went forward and plowed the balance of this field, and after he had finished, he treated the whole field alike—put his manure on the surface, harrowed it, and put the field into corn; and he says that as far as any one could see the field, the difference between the portions plowed in the spring and in the fall was plainly visible. The explanation he gave was, that the fermentation after the spring plowing produced such a warmth for the corn plant, that it was favorable to its early growth, and it was not

packed and matted together by the rains and by the surface water of the winter, so that the roots of the plants could not permeate the soil in every direction. He tried the experiment several times, to be sure, and the same result followed. I have always followed that plan. I never plow in the fall unless I have very clayey ground, that I want to disintegrate somewhat, and plow it several times. This is digressing a little, however.

MR. GOULD. From the time you turn the sod over in the spring to the time you take the tobacco from the poles, will it cost you to exceed a hundred dollars an acre for the labor and manure which you apply to it?

DR. RIGGS. I should think it would cost more than that. I should not like to say positively how much it costs, but fully $200 an acre.

MR. GOULD. Would that surely cover it?

DR. RIGGS. It would approximate to it.

MR. GOULD. Would $250 be sure to cover it?

DR. RIGGS. That would be sure to cover it, unless your land is very poor, and you have to put on an immense quantity of manure.

MR. GOULD. In your own practice, will $250 be sure to cover it?

DR. RIGGS. Yes, sir, it will. On my land, I suppose I could raise a reasonably good crop next season without any manure. I could not get as much after this year.

MR. GOULD. Will the crop sell for $800, sure?

DR. RIGGS. I raised last year, on an acre and a half, from 1½ to 1¾ tons of tobacco.

MR. GOULD. What is it worth a pound?

DR. RIGGS. I intend to get from 45 to 50 cents a pound for my tobacco.

MR. GOULD. All round or simply for the wrappers?

DR. RIGGS. My fillers will not amount to much. I will give you the figures of some that we had cultivated on shares last season, which was sold low, because the man was a weak holder and was anxious to get his money. The land was not so good as mine, and the crop not as large. There were

about three acres in the piece. He got of wrappers, 3,739 lbs.; seconds, 613 lbs.; fillers, 141 lbs. It was sold at 35 cents per pound, amounting to $1,377. The seconds sold for 10 cents, and the fillers for 5 cents. The seconds were worth 20 cents, and would bring it. The whole of the tobacco ought to have brought 45 cents. The difficulty was, he sold rather early. The tobacco was of good quality but not the best. When I bought the land upon which that was grown it would not bear anything.

MR. GOULD. That is a profit of $209 an acre, selling it at this low price, assuming that it cost $250 an acre. Do you think it cost that man that amount to make it?

DR. RIGGS. No, sir, I furnished the manure and furnished the team. He is a Protestant Irishman, with a family of three children, struggling to get along, and I always try to help such men. I could let my land to better advantage, but he is honest, industrious and energetic, and I like to see such men helped.

MR. LOW. I move a vote of thanks to the DR. for the information he has given us, and for the great patience with which he has allowed us to pump him. Carried.

MR. ALLEN, of East Windsor. I have listened with a great deal of interest to the remarks which have been made, and the Doctor has saved me the trouble of going over this ground very minutely. I wish, however, to notice some things which he has inadvertently, no doubt, passed over.

The first thing of which I would speak is the seed bed or plant bed. If any one should ask me what I think the most essential thing in raising a good crop of tobacco, I should say, early plants. Of course, there are a great many things that are essential, but I regard that as the most essential. I do not think it is necessary to start under glass, if you pursue the right course. Tobacco, you know, is a tropical plant, and the season in this latitude is not too long to raise and cure a good crop of tobacco, no matter how early you begin. You can raise a crop, you can get the full growth of the tobacco, and hang it up the first day of October or the middle of October, if the frost holds off long enough, but then you have no

time to cure it. After you get the crop in the shed, if there comes a cold, freezing night, as is often the case in New England, it will freeze. The tobacco crop must be hung up early enough to be cured before the cold weather in the fall. That will certainly freeze it, for no tobacco shed was ever built tight enough to protect it from such freezes as we frequently have in October and the first of November. So that our season is none too long, begin as early as you please, to raise and cure a good crop of tobacco. We must then begin early with the seed bed, and I will describe to you what we, in that portion of the Connecticut valley where I live, consider the proper way of preparing a seed bed.

We begin this operation in the fall, early enough to be sure that we can do it. Some of our farmers put it off so long that the ground freezes before they begin, and then they cannot do it. We select the best manure that we can find, free from seed; one great point in preparing the seed bed, is to have it so arranged that the weeds will not trouble the plants. Some gentlemen among us, who have given the most attention to it, and have beds in which they have raised plants for four, five or six years, do not spend more than a day in weeding a bed for five or six acres of tobacco. The beds are perfectly free from weeds, and when kept for years, and properly managed, the plants will not be troubled with weeds. The custom of some of our farmers is, not to use any barn-yard manure on their seed beds; they use Peruvian guano, sowingit in the fall and plowing it in, in order that its sharp and caustic nature may be subdued a little, so as not to injure the seed when it is sown in the spring. It is universal with our best tobacco raisers to manure in the fall, and plow in. Some use superphosphate; and the best kind of superphosphate is an excellent thing; and some use fish, which is also an excellent manure for tobacco plants. The experience of these gentlemen has taught them, that manure which is free from weeds is an essential thing to use upon a tobacco bed.

In the spring, the bed (unless it is very light soil) is plowed again thoroughly. Some just harrow it over, sow the seed, and roll it in; but I think the general custom is to plow the

seed bed in the spring. The best way is to plow it, level it off with a rake, sow the seed, and roll it in. Some tread it in, but the better way is to use the roller, for it leaves the bed more smooth.

Mr. Low. How many square rods are required for one acre?

Mr. Allen. I raised five acres this year, and I had a bed about as long as this room is wide [some forty feet] and eight feet wide.

Mr. Low. It takes a very small amount of fertilizers for that small amount of land?

Mr. Allen. Very small. You can raise an enormous number of plants from a small bed. Considerable skill is required is sowing the seed. If it is too thick, the plants will be worthless, because they will be all crowded together, and spindle up, and have neither root nor top that is good for any-thing. You want a tobacco plant with a thick mass of roots and a stocky top; not a top that runs up high, but a round, thick, heavy top. That is the kind of plants wanted, and gentlemen who are accustomed to sow the seed can get it thick enough. The old-fashioned rule was a thimble full of tobacco seed to a square rod. I sow a little more, in order to be sure to have seed enough, and if it comes up too thick, I thin out, and leave the plants standing just as thick as I want them.

I do not know that I need say any thing more in regard to the seed bed. I think I have heard it said that tobacco plants will not be injured by frosts. That is an error. Tobacco plants will be killed by heavy frosts, and it is some times necessary, especially for the first few days, to protect them. When the seed is sown my plan is to cover the bed with birch brush, or some fine brush—something that will cover the bed. I cover it thick, and it serves a double purpose; first, to keep the ground moist, and prevent the wind from blowing the seed off, for it lies very near the surface, and secondly, to protect it from the frost. I leave that on until the plants come up and get large. I find that they grow better under this shelter than they would with the brush off. I take off the brush when the plants need weeding, and sometimes put it back again.

It is necessary sometimes to water the bed. In fact, I have saved my tobacco bed entirely by watering. There will occasionally be a very dry spell about that season of the year, that will check them very much. My object is to keep them growing from the time they first come out of the ground until they are ready to set, and a few days watering will sometimes keep them growing, when, but for that, they would stop. I have found sometimes that a weak solution of Peruvian guano will help them along. Put a handful into a pail of water,—do not get it too strong, for if you do, it will kill your plants,—and just sprinkle it over your bed.

QUESTION. What do you think of the drainings of the manure cellar?

MR. ALLEN. First rate. I have used them, and they are just as good, perhaps better, than guano.

QUESTION. Do you ever sprout the seeds before you sow them?

MR. ALLEN. I do not. Some of our people do, but it is a dangerous operation; it is not quite safe. If you sprout your seed, and it comes up quickly after you sow it, and you have the soil in just the right condition, it does well; but if you sow your seed, and it is very dry immediately after, or very cold, your seed is spoiled, and you lose your plants. It is rather a critical operation, and I prefer to sow it dry; and I never fail to get early plants. I sow it just as soon as the ground can be plowed, no matter if it is in the middle of March, or first of February.

QUESTION.—Do you mix the seed with plaster or any thing when you sow it?

MR. ALLEN.—If I mix it with any thing, it is for the purpose of sowing it a little more conveniently. My plan has been to mix the seed with ashes or plaster and ashes, which is a very good application for the bed, and then sow it broadcast. I can do it more evenly than by taking the seed alone and sowing it with my thumb and finger.

QUESTION.—How large ought the young leaf of the plant to be when you set it out?

Mr. Allen.—The largest leaves ought to be as large as the palm of your hand; but we set them smaller than that, and set them larger than that. If I could have my choice I would like to have the largest leaves about as large as the palm of my hand.

Question.—What time do you want to be ready to commence setting in order to have the best results?

Mr. Allen.—Before the middle of June, I think, or by the middle of June. My plants last year were all set before the 10th of June.

Question.—Don't you wait for suitable weather?

Mr. Allen.—It is very much better to have moist weather, but I do not wait for that. When my plants and ground are ready I begin to set. It takes very little water to water the plants. If you leave just a little place around the plant for the reception of water, it does not take a great deal to water the plants. Once watering is sufficient if your plant is properly set. Then we sometimes cut a little grass and cover up the plants. In that way we save the annoyance and discomfort of setting out the tobacco in a rain; but if you can have it, that is the right time. I have noticed that from the first to the middle of June we almost always have three or four days of lowering, misty, cloudy weather, with just rain enough to have the plants stay in good shape. Sometimes it comes a little earlier, and if we can have all things ready, that is the time to set out the plants. A great many tobacco raisers make a mistake in that regard. They put off preparing their land too late. They will have their plants all ready, and their tobacco ground about half or quarter ready, and then comes a rain, and the hands must hurry into the field and fit up the tobacco ground, and by the time that is fitted the rain is over, and they have to set out their plants in the sun. Every foot of your tobacco ground ought to be prepared by the first of June, so that when your plants are ready you can take them up and go into the field, and take advantage of any day that happens to come along that is favorable for the business.

Question.—What time do you want your plants ready to hang up?

Mr. Allen.—I began to cut this year the 20th of August. I finished the 10th of September. I prefer to have my tobacco all hung up in the shed before the 10th of September. That is about late enough to hang up a crop of tobacco in the region where I live. I can not trust it out much later than that. Frosts may come and injure it in the field, and if I hang it up in the shed very much later than that it is likely to be frozen in the shed, and it does not make any difference where it is frozen.

Question.—Do you agree with Dr. Riggs in regard to ventilation?

Mr. Allen.—I think he has given a description of an admirable shed. I have one on a somewhat similar plan. I do not know how it could be bettered.

Mr. Hart.—What are the general characteristics, as to texture and color, of the best tobacco?

Mr. Allen.—Well, sir, the doctor answered that question very accurately, I think, whatever may be the fashion with the cigar makers. We raise the wrapper leaf, and the quality which is required is a thin, tough, elastic leaf, the thinner the better, if it is only tough enough and elastic enough to wrap the cigar. The reason is this. You can take Havana tobacco for the filling of a cigar, and use a seed-leaf for the wrapper, and the wrapper is so thin that it will not impart any of its peculiar flavor to the cigar, and you would not know you were not smoking a pure Havana cigar. This leaf has become so valuable, on account of its elasticity, that large quantities are taken to the island of Cuba, wrapped around Havana tobacco, and the cigars brought to this country and sold for pure Havanas, and it would take a very good judge to discover the difference. I do not know that any one could. Our leaf, by reason of this peculiarity, has risen in value very materially, being sought for all over the world. It is carried to Europe, and the market is extending in every direction; and that is the reason why our tobacco is bringing a higher price this year than formerly. It is not so much because the tobacco crop is poor, or because the market is bare of the article, as because of its intrinsic worth as a wrapper leaf.

Mr. Hart.—Has there been any locality yet found where they raise the same quality?

Mr. Allen.—There is no locality upon this continent where they raise so fine a leaf as they do in Connecticut. I do not wish to say any thing against Massachusetts. The Connecticut seed-leaf raised in Massachusetts is sold in the market as the Connecticut seed-leaf, and they raise some very good tobacco there; but I am told that it will not compare with Connecticut tobacco. It has been carried to Ohio and New York, but they can not produce that peculiar fineness of leaf that we can produce in the Connecticut valley. There is something peculiar about that. It is so upon the island of Cuba. There are only two or three localities there where they raise the very finest kind of tobacco.

Mr. Gould.—Is not the soil around Northampton geologically identical with that of the Connecticut valley?

Mr. Allen. I think it is very similar.

Mr. Gould.—Is it not more owing to the fact that the Connecticut raisers are more accustomed to the manipulations required for seeding and the planting?

Mr. Allen.—I suppose you have hit the point. If there is any gentleman here who contemplates going into the raising of tobacco, I wish to say to him that it is a very nice business. I do not know any thing that requires such skill, such constant attention, such perfect acquaintance with the business, from the time you prepare the seed to the time when you put the tobacco into the box, as tobacco raising; and if a man is not thoroughly acquainted with the business, if he is going into it to the extent of two or three acres, he had better send for some man who does understand it, or he will be likely to lose all his labor, for one single false step will ruin his crop. If you cut down your tobacco at the wrong time, the wrong hour of the day, you will lose the whole of it; it will be burnt up, and not worth a straw. Or, if you take it down a week before it is cured, you will lose your tobacco. The stems are the index. The leaf may be perfectly cured, and all but two or three inches of the stem be full of moisture. If you take it down in that state you will have to hang it back again, or lose

it. It will never dry up any below. The only safe way of getting out of that scrape is to string it right up again on your poles. So all the way through, the closest attention is required in order to secure your tobacco.

My practice, and the practice in the vicinity where I live, is to allow the buds to appear, and a few of the blossoms, before topping. We do not let the field blossom out, but the buds appear, and once in a while you will see a blossom formed as you look through the field. There is one reason for this. We want to get the field in as uniform a state as possible, that we may top it all at once. The doctor's plan of topping low is a good one, but there is one thing which he practices which we never do; I never saw a man do it in our part of the county. He says he breaks off the lower leaves. We do not do any thing of the kind.

Dr. Riggs.—May I inquire what the condition of those bottom leaves is in your fields?

Mr. Allen.—We prepare our land in a way similar to yours. We do not use a plow, but a "ridger." This instrument is like an A harrow turned the other way round. It makes a ridge about six inches high. Then there is a piece of iron that comes along behind and smooths off the top, and you have a ridge all ready for setting. Then we have a reel, made like the reel of an old-fashioned spinning-wheel, a light thing, and on the frame of that we nail little pieces of wood, just the right distances apart, for a man to take hold of and draw through the field and mark out the hills, just so far apart, and then your ground is all ready for the plants.

Question.—How close do you set your plants?

Mr. Allen. Twenty, twenty-two and twenty-four inches. That depends a great deal upon the kind of tobacco you are raising, and a great deal upon the character of your soil and the condition of the land. If your land is prepared as it ought to be, the plants ought to be set about twenty-two inches apart, I should say.

Question. The rows?

Mr. Allen. Well, three feet or a little more. The object in setting so thick is to get a fine leaf. There are half a dozen

kinds of tobacco. The best kind that I know of is the kind where the leaves are set near together on the stalk, not very long but wide, and tapering to a point, and the stems growing out at right angles with the main stem. The stems are very fine, so that when you turn the leaves over on the back those little stems that run up through will lie almost flat with the leaf; and when you stretch out the leaf the back of it will be almost as smooth as the front. That is what I call a fine leaf.

MR. YEOMANS. What would be the effect of leaving the sprouts? I understand that in Northampton and Hatfield they have tried that somewhat, thinking that the tendency was to make a finer leaf, and perhaps get something more nearly like the Connecticut leaf.

MR. ALLEN. That would be the result, no doubt. It would take the substance from the leaf and it would be fine. But I do not think that is necessary. In fact, it would detract largely from the weight of the leaf, and from the quality of the leaf, I think, ultimately.

The suckering should be done early, before they are large, and then they can be taken off without any trouble. Last year the tobacco, as a general thing, got a very rapid growth, the suckers came out very rapidly, and the tobacco was so large that it was almost impossible to get into it. My men went down and began to sucker it, but after they had been through two or three rows I found they were destroying so much of the tobacco, that I told them to stop at once. This year I had to leave the suckers on a whole field. It was a complete mass of blossoms before I could get at it. It was a necessity; I should not have done it if I could have got into the field.

QUESTION. Would it not be worth while to set the rows farther apart?

MR. ALLEN. Ordinarily we do not have that trouble. This year we had an extraordinary growth. I think perhaps it would be well enough to put them far enough apart to avoid that difficulty.

QUESTION. In hoeing your tobacco, how do you manage it? Do you put any earth around the plants?

MR. ALLEN. No; I never put anything round the plant. We set out the tobacco in the way we think it ought to be set out, and then hoe it and keep the ridges in their original position, in order that the bottom leaves may not rest on the ground. The ridge protects the bottom leaves. We do not design to pull any earth away from the plant, but just stir the ground around it.

Another thing which I deem very essential is this: the earth around the plants needs to be stirred very soon after they are set. Just as soon as you are sure they are going to live, if it is the next day after they are set, you want to set your hoe going and keep it going. Keep your tobacco land thoroughly pulverized; do not allow it to get baked up. The great secret in raising tobacco is to keep it growing from the time you put it into the ground until you harvest it. Any check, whether from lack of manure, from drouth, or from too much water—any thing, no matter what, that checks the growth of the plant, injures your leaf, and there is where the white stem comes from. But if you can keep your crop growing from the time the plants are set until you hang it up in the shed, I don't think you will have any trouble. You may have such a season as they had out west, with no rain at all to dampen the tobacco, but if you can have a fog once a week that will come into your shed and dampen your tobacco down thoroughly, and then the wind blow up and carry it off, you will have a good quality of tobacco. But if, when you hang it up, it is a dry time, it will dry up and there will be no character to the leaf. That is what is the matter with the Wisconsin, Ohio, and Michigan tobacco this year. It has been dried up so that the leaf has no character. That was the trouble a year ago this fall, it was so dry.

QUESTION. Does your tobacco ever burn black?

MR. ALLEN. Not very often, unless it is in clay. A clay loam is the worst kind of soil to put tobacco on.

MR. ———. I am told that Peruvian guano will make it burn black.

MR. ALLEN. I have heard it said that it would, but I do not use enough on my land to affect it any way.

QUESTION. You prefer barnyard manure?

MR. ALLEN. I do.

QUESTION. You get the best and finest leaf?

MR. ALLEN. I do.

DR. RIGGS. Why do you use barnyard manure exclusively?

MR. ALLEN. I do not use it exclusively. I use phosphates some and a small quantity of Peruvian guano. But I use stable manure generally. I think I can get the best quality of tobacco from that; I know I can.

DR. RIGGS. You want the leaf-mould or humus, and all the vegetable matter of barnyard manure?

MR. ALLEN. Yes, sir. I think that is the best preparation we can find. We cannot get enough of it. So we have to take something else.

MR. YEOMANS. I was in Hatfield last fall, and had occasion to travel round a little among tobacco growers, and came in contact with one or two who had used the Newton marl as a fertilizer. One gentleman in particular, who had applied it with other fertilizers, told me that he had found it superior to any other fertilizer that he had used, and the quality of the tobacco was very superior. He said that if it was as cheap this season as it was last, he should put it on at the rate of two tons to the acre, and thought he should get excellent tobacco.

I want to say a word as to the effect of tobacco upon the soil. It has been asserted over and over again, that tobacco is a great exhauster, leaves the soil in a very poor condition, and will ruin any farm after it has been raised there a while. I do not think so. We have raised tobacco in the Connecticut Valley for sixty or seventy-five years, and our tobacco lands are the richest we have. The best lands in the Valley to-day are tobacco lands. Our custom is to raise tobacco on a field two, three, or four years, then seed it down, and let it lie in grass three or four years, and then put it into tobacco again; and these lands are growing rich. They are more fertile now than when we first began to cultivate them in that way. You see that in order to raise a good crop of tobacco,

you must have your land in fine condition; it must be kept perfectly free from weeds, and land that has been cultivated in that way for five years, kept perfectly free from weeds, and the soil in such condition as is necessary to raise a crop of tobacco, is in fine condition for anything. I have never seen anything refuse to grow on such land. Any crop will grow, and grow luxuriantly, and the land will grow better all the time.

I think the theory is all wrong that tobacco is such an exhausting crop. I know the peculiarity of it is that the rapidity of its growth is such that it needs to have the best ingredients in the soil in such a soluble condition that they can be taken up readily, that the plant may grow right along without any check. That is the condition in which land must be in order to raise a good crop of tobacco. It does take up its food from the soil very rapidly, but I do not think it takes such a large quantity. I would rather raise a crop of tobacco than a crop of corn. I think corn will exhaust the soil faster than tobacco.

DR. RIGGS. The practical value of your manure you consider to be the ammonia and vegetable matter? If you had the ammonia and the vegetable matter from any source, would you not be likely to get good crops of tobacco?

MR. ALLEN. I suppose so. I have never gone into these things much. I keep a large stock of cattle and make a large quantity of manure, and I use that with such things as will make the tobacco start—super-phosphate and Peruvian guano. I use these for the purpose of starting the tobacco, but the barnyard manure is the staple thing, after all. I have never failed to get a crop. My crops have averaged over a ton to the acre. The price has varied a good deal. Very early in the season some gentlemen came up from New York city and bought a few crops at what we call a low price, from twenty-five to thirty cents a pound; but pretty soon the farmers began to see the crop was sought for, and they held on to it, and within the last two weeks tobacco has been sold for from thirty-five to sixty cents a pound all round, and in one instance a gentleman sold his crop for ninety cents. That is the highest price that I have heard paid.

MR. DAY. I am aware that what was originally the old town of Windsor has some of the finest land in the state of Connecticut, and that there is some of the finest tobacco soil there that there is in the United States, perhaps. I have heard that there were large quantities of manure taken from the city of New York and brought up to that town, at an expense of twenty dollars a cord. Mr. Allen has stated that his tobacco land invariably produces good crops, and under this system of heavy manuring, it must; but I want to inquire more particularly what is the character of the outlots around, and what is the effect upon their farms in the aggregate?

MR. ALLEN. Well, sir, the outlots are no worse than they were when we began, and some of the farmers are bringing them up, recuperating them; they have the means to do it with. The best tobacco growers, those who have made it their business and been the most successful, are the best farmers we have in the county, in all respects. You cannot name a branch of their business that is not, as a general thing, well attended to. There is once in a while a man who does not do anything but raise tobacco, and has only four or five acres of land; but I am referring now to large agriculturists, who have from one to two hundred acres.

MR. DAY. The gentleman has stated that they get large crops of grass after tobacco. I want to know from Mr. Allen, whether he gets as large crops of grass from that land with the high manuring and culture that he gives to it, with the inducements of a large crop of tobacco, as he would if he put it into corn or potatoes with the same amount of fertilization, the same amount of pulverization, &c.

MR. ALLEN. I do not know what the result would be if it was planted with corn instead of tobacco, but I do not see how it could do any better, for the grass we cut is as heavy as we can mow with the machine, and if corn would give us any bigger grass, I don't see how we could cut it. I do not believe that raising corn would leave the land in any better condition for grass. In fact, I have found more difficulty in getting almost any crop, including grass, to grow after corn

than any other crop. A crop of potatoes prepares the land admirably for almost anything; you can get almost anything to grow after potatoes; at any rate, it is so with us; but corn is the worst crop you can put on a piece of land to prepare it for tobacco. It takes more of the vitality out of the soil than anything else I raise.

MR. DAY exhibited a specimen of tobacco, which he said was raised in Windham county, and inquired if the soil of that county was adapted to the growth of the plant.

MR. ALLEN. I was at Mr. Sumner's a few years ago, and he asked me the same question. I replied that I did not see any thing in the character of the soil about there to prevent their raising a good quality of tobacco. I am not familiar with the land of Windham county, and cannot answer your question very intelligently. I was asked the same question in Woodstock, and replied that I thought good tobacco could be raised there. There is good tobacco land there, but how it is in other towns, I don't know.

DR. RIGGS. I would like to say a word in regard to sowing the beds. The great difficulty is in getting the seed even. My mode is to take a common watering pot, with holes large enough to admit of the passage of the seeds and water freely, fill it with water, and go over the bed, keeping the water agitated all the time. Covering the bed with brush, I maintain, not only attracts the sun but retains the heat after it has once penetrated through the branches.

MR. DAY. There is another question to which I should like to call Mr. Allen's attention. It is in regard to the cultivation of tobacco upon comparatively light, worn-out soils, that need renovating. I know that it requires a large amount of manure to bring these lands into the high state of cultivation necessary for the production of tobacco, and what I want to inquire is, whether it is more profitable to expend a large amount of money for manure or to sow buckwheat on these lighter lands, and as soon as the buckwheat is sufficiently matured, before it begins to seed, turn it under, and in the early part of September, perhaps, put on rye, with some stimulant, like superphosphate, guano, or ashes, and induce an

abundant crop of rye, and then put on tobacco? Mr. Allen will notice that the expense of the preparation of the soil in one instance is very much less than in the other; and perhaps the crop of tobacco would be proportionately less. The question is, whether a person will make more money by plowing in green crops successively, or by making this large expenditure for animal manures.

MR. ALLEN. My reply to that would be, that I do not think it would make very much difference. It is a fact in our experience, that a pretty good application of manure to a worn-out rye field will produce a good quality of tobacco, if it is not so very large it is fineness of leaf we are after; and my advice to any gentleman who has a field of that kind, and who is going to raise tobacco, would be, "Put on your manure to begin with, plow it in, plant with tobacco, and you may expect to get a good quality of tobacco, but perhaps not so large a growth as you would like. The second year, put on all the manure you can, and you will get more tobacco, and the third year, more still. Then lay down to grass."

MR. DAY. It is almost impossible for some farmers to get a liberal supply of manure. In such cases, would you advise the course I have suggested?

MR. ALLEN. Undoubtedly, if you have not got the manure plowing in green crops is a very good thing for tobacco. I have no doubt of it at all.

MR. DAY. I will ask whether plowing in green crops has different effects on different kinds of soil?

MR. ALLEN. Perhaps the same physical effect would be produced. It has the physical effect of loosening up the soil, and the decaying vegetable matter furnishes a humus which will make it more moist. I suppose it will have more effect on dry land than on wet land.

MR. DAY. I ask the question because I have several times plowed in green crops, and never saw any beneficial effects from it. I have supposed there might be some acidity connected with the green crop that did not agree with my particular kind of soil. I have always found my land improved by

a good sod, but I never found any benefit from plowing in a crop.

DR. RIGGS. There is no question that a crop that is matured and dry will produce more effect when plowed in than a green crop. I consider a clover crop that has perfected its seed, whether the seed be gathered or not, if the stems are all dry, a third or a half better than to plow it in perfectly green. But in the case of the rye crop, I have to plow that in to get the vegetable matter. I have to raise a crop after my tobacco and get the land ready for the next crop of tobacco, hence I cannot let it mature.

W. W. WHITE, of Putnam. I have in mind a piece of sandy loam on which buckwheat was raised for eighteen years. It was plowed every June, and whatever grew upon it was turned in; it was sowed for eighteen years, and the last buckwheat was as good as the first, and rather better. That land, originally barren, would raise a very nice crop of ordinary tobacco. It never had received any manure for eighteen years; but we have been plowing turf, as a general thing, for one crop or two, and never saw any difference. The land was improved, and the crops improved by that process. One of my neighbors has a piece of land that is too light to cart manure upon, and he has invariably sowed clover, turned it over in August, and sowed rye, and taken off a crop of rye; and he says that in eight years the crop became so heavy that it lodged. In that case probably part of the clover ripened and went to seed.

Adjourned to seven o'clock.

Evening Session.

The Evening session convened at the usual hour, a large audience, very many of whom were ladies, being present. Hon. E. H. Hyde occupied the chair, and introduced as the lecturer of the evening, Hon. Francis Gillette. Subject:

THE BIRD IN HIS RELATIONS TO MAN, AND THE WORM OR THE INSECT WORLD.

At the conclusion of Mr. Gillette's lecture, a vote of thanks was unanimously passed for his very interesting and beautiful address.

The President then introduced Mr. J. Stanton Gould, of New York, who addressed the assembly on "the relations of Agriculture to Railroads and Common roads."

On motion of Mr. Stewart, a vote of thanks was passed to Mr. Gould, for his able and eloquent address upon the subject of railroads.

The meeting then adjourned.

Fourth Day.

The Board met at the usual hour, Vice-President Hyde in the chair.

Mr. Yeomans, of Columbia, offered the following resolution:

State Board of Agriculture,
Danielsonville, *Jan.* 12, 1872.

Resolved, That the thanks of this Board be extended to the several railroad companies of this State for the accommo-

dations and facilities afforded to the members of this Board and others in attendance upon the meetings of said Board.

Mr. Yeomans. I trust that it is not necessary to say any thing in support of this resolution. We are well aware that these facilities have been extended by the several railroad companies, and the Board is very grateful to them for these favors.

The resolution was unanimously adopted.

Mr. Yeomans also presented the following resolution, which was received with applause, and adopted:

State Board of Agriculture,
Danielsonville, *Jan.* 12, 1872.

Resolved, That the thanks of this Board be extended to the Press of this and adjoining States, for their efforts in extending the notice of this meeting, and also for their attend ance upon and notices of our proceedings.

Mr. Stewart, of Middle Haddam, offered the following resolutions, which were passed unanimously:

Resolved, That the thanks of this Board be returned to the citizens of Danielsonville and vicinity for the kind and cordial hospitality extended to the members of the Board, and others in attendance.

Resolved, That the thanks of this Board be returned to the members of the Windham County Agricultural Society, and the Woodstock Agricultural Society for their hearty welcome and efforts to further the objects of the Board.

Address of the State Entomologist, S. I. Smith, of New Haven:

Mr. President, Ladies and Gentlemen:—With the advice of our Secretary, I have thought it best this morning not to attempt to make a detailed report, but only to present a few

facts showing the importance to all those engaged in agricultural operations, of the study of insects, and, if possible, to make apparent how necessary to the farmer is a practical knowledge of their appearances, structure and habits. The ravages of insects are so familiar and yet so little understood, that we have come too often to regard them as the result of direct and unavoidable acts of Providence, no more under our control than droughts, severe storms, or unseasonable frosts. We spare no pains to prepare the fields, plant the seed, or destroy the weeds, but when insects appear, we blindly submit. If insects were as well understood as the weeds, I see no reason why we might not as successfully combat them. Although there is so much complaint of the ravages of insects, few people have any adequate idea of the amount of injury they do annually.

In illustration of the injury done to crops by insects, I need only allude to the destruction caused by grasshoppers the past season, or to the banishment of the wheat crop from New England. Undoubtedly many causes have combined to drive the cultivation of wheat from the Eastern States, but I think all intelligent farmers will acknowledge that the attacks of insects have been at least one of the principal causes. Even at the west the damage done to this crop alone is enormous. According to the estimate of Dr. Schimer, "in the year 1864, three-fourths of the wheat and one-half of the corn crop were destroyed by the chinch-bug throughout many extensive districts, comprising almost the entire Northwest." In the single State of Illinois he estimates the damage done in that year to the wheat and corn crops by this one species of insect, at over seventy-three millions of dollars. This, to be sure, is an exceptional case, but it indicates the amount of injury that may be done by a single species of insect; and there are others which are nearly as destructive. The European cabbage-butterfly, which first made its appearance at Quebec in 1859, and has now spread over all the eastern part of the country, is stated by Abbe Provancher, a Canadian entomologist, to have destroyed in one year about Quebec, cabbages to the value of $250,000. According to Dr. Fitch, the Hessian fly destroyed, in the State of New York, in

1854, wheat to the value of fifteen millions of dollars. The army worm of the north, which committed such ravages over a large part of the country in 1861, is said to have done damage that year to the extent of half a million of dollars in eastern Massachusetts alone.

These are all instances of injuries done by single species of the more destructive insects. When we remember the vast number of species of insects there are, and how many species attack each one of our cultivated plants, we begin to have some idea of the aggregate amount of the injury they cause. At least a hundred species attack our cultivated cereals and grasses, and probably as many more feed upon our other field crops. At least seventy-five species attack the apple alone, and the shade and forest trees fare no better. Dr. Packard calculates the total annual loss in our country from noxious animals and the lower forms of plants, such as rust, smut and mildew, as not far from five hundred million dollars, and considers it a low estimate. I have not alluded in these remarks to the injuries which insects and closely allied animals do directly to man himself, and to domestic animals. Prof. Verrill has given a full account of these in his lectures on the "Parasites of Man and Domestic Animals," in the Report of the Board for 1869, and has shown to what an extent we suffer from them.

There is another phase of this subject which I think should be brought out more clearly than it usually is. We are too apt to regard insects, if we think of them at all, as wholly injurious, I wish to correct this idea, which is too often promulgated. The lecturer last evening fell, unintentionally, perhaps, into this common error, condemning as our enemies almost the whole class of insects, and in turn exalting into friends almost all the birds. Practically we can make no such broad distinctions. Vast numbers, whole groups, in fact, of insects are entirely beneficial, and many others more friends than foes; while the birds, likewise, must be divided into friends and enemies.

Of those insects which are directly beneficial to man, your attention need not be called to the silk worms, to the honey-

bee, to insect product such as cochineal and lac. Medicine even is indebted to insects for many of its remedies. Not only, as in most of these instances, by their products are insects directly beneficial—they themselves furnish food for many useful animals and even for man himself. We are inclined to look with distrust upon insects as food, but in other countries they have and still do afford man great quantities of food. We are told in the Bible how John, in the wilderness, lived upon locusts and wild honey—certainly entomological food. The Indians west of the Rocky Mountains still use grasshoppers and other insects as food.

Indirectly, insects confer vastly more important benefits, some of them all unnoticed by us. First, they act as scavengers, as sanitary agents, removing all sorts of injurious substances. We have in the house-fly, although it is such a nuisance, one of the most important scavengers. The burying-beetles, also, do good service in this way. If there is a dead insect, little bird or mouse, in a field or pasture, these beetles dig under it, it falls into the earth, and is covered up. In this way, not only is the offensiveness of the decomposing matter avoided, but all the fertilizing properties are retained in the soil and made advantageous to the farmer. Insects also do a great work in destroying and removing large masses of carrion. The excrement of many animals constantly falling upon the ground is attacked, undermined, devoured, scattered abroad by a hoard of insects.

A far greater number of insects are beneficial by destroying injurious species, which are kept in check more in this than in any other way. Of these beneficial species, there are two principal classes. First, those which are predaceous, preying directly on other species, capturing and devouring them; second, the truly parasitic species. In the former class we have the tiger-beetles, which are destructive in all the active stages of their existence, the grubs, armed with immense jaws, living in holes in the ground and devouring every living insect which falls in their way; the full grown beetle, like miniature tigers, lie in wait and pounce upon weaker species. Hundreds of other carniverous beetles are equally

voracious. The mud-wasps, sand-wasps, and their allies, provision the nests for their young with other insects, destroying in this way multitudes of injurious larvæ and winged insects as well. One of our largest sand-wasps even captures the cicada and stores it up as food for its young; another species captures grasshoppers; another seems to prefer the canker-worm, and so on. The sting of all these wasps which store up insects for their young, has the peculiar property of paralyzing the victims without destroying their life, so that they live a long time, a supply of fresh living food for the young wasps. All the dragon-flies and their allies feed exclusively on other insects, devouring vast numbers of the smaller forms.

But the class of parasitic species is, of all, by far the most beneficial. They attack every injurious species in some or all its stages of growth. No species is free from their attacks. The army-worm, for example, is known to be attacked by at least nine different species of true insect parasites, two species of two-winged flies, somewhat like house flies, and seven ichneumon flies, or their allies. There are also large carnivorous insects which prey upon them. The canker-worm is undoubtedly kept in check more by parasites and other insects which prey upon it than by all its other enemies combined. The most important of these parasites is a minute four-winged fly, the little larva, or maggot, of which lives within the canker-worm's egg. The female of this little fly, no bigger than a pin's head, goes from egg to egg of the canker-worm, punctures each with her ovipositor, or sting, and deposits in it one of her own eggs. From this little parasite's egg, too small to be noticed by the naked eye, hatches a maggot which lives within the canker-worm egg, where it finds food sufficient for its sustenance till it is full grown, when it changes to a chrysalis, and finally into an adult which gnaws a hole in the canker-worm egg-case and escapes a little fly like its parent, to repeat like operations upon a fresh crop of canker-worm eggs. These little parasites of course prevent the hatching of the eggs which have served for their snug habitation, and, as they are very abundant, they do a great service in destroying

this pest of our orchards and shade trees. The canker-worm is attacked by other parasites, and great numbers are eaten by carnivorous insects as well as by birds and other animals; but our little egg-parasite is undoubtedly their most destructive enemy. Knowing the habits of these enemies of the canker-worm, we can readily understand the sudden diminution and increase in its numbers during a series of years. It may be well to state in connection with this that they never wholly disappear; for, any year, a careful search will reveal a few at least on almost every tree which they are in the habit of infesting. These few are so scattered they are not easily found by parasites and other enemies, and hence these enemies diminish very rapidly in numbers, till finally a series of years happen to be favorable for the increase of the canker-worm and they multiply enormously and entirely out of proportion to the numbers of the parasites. Soon the canker-worms overstock the trees they inhabit and their very abundance gives plenty of food for the parasites, which increase so rapidly in consequence as to overcome them in a very few years. I know the disappearance of the canker-worm is frequently ascribed to other causes. Their last disappearance in the region of New Haven, was ascribed by many to the introduction of the English sparrow. Watching them in the last year of their abundance, however, it was quite evident that the sparrows were not the most efficient of their enemies. It was not uncommon to see one of our little parasitic flies close to a female canker worm, while she was depositing her eggs, and puncturing every one of them while still freshly laid and soft. Sometimes several were at work on the same cluster of eggs, contending for the opportunity of depositing their eggs. Other enemies of the canker-worm increased in similar proportions. In the spring and early summer, both while the females were going up the trees to deposit their eggs, and afterward while the worms were coming down, a big metallic green beetle, which in ordinary seasons is very scarce and seldom seen, appeared in great abundance, a dozen being frequently found about a single tree, devouring the helpless females or worms as they came along. With such an army of insect destroyers

is it a wonder the canker-worms were scarce for some years succeeding?

Many of our most injurious species are imported from abroad, and it frequently happens, very unfortunately, that the species come without bringing its parasites with it, or at least only a part of them. This is undoubtedly the reason these introduced species frequently spread with such alarming rapidity, until at last some of the native parasites attack it and multiply so as to check its increase, or some of its foreign parasites are brought by chance to the rescue. As yet none of the old world parasites of the European cabbage butterfly have been observed to attack it in this country, and native parasites have thus far almost entirely neglected it. This destructive butterfly, supposed to have been introduced at Quebec twelve or fifteen years ago, left thus unresisted, has already spread over all the eastern part of the country. The wheat midge when first it appeared in this country is said to have been free from the attacks of parasites, which accounts for its rapid diffusion and the great extent of the damage which it caused.

In addition to these more apparent and familiar ways in which insects are beneficial to man, great numbers of species render an essential service—are in fact an absolute necessity—as pollen bearers. This office which insects perform is, I fear, almost entirely overlooked by the farmer, while he owes to its faithful performance the fruitfulness, and in fact the very existence, of many of the crops he cultivates. You are aware that our common plants mature no seed unless some of the pollen, or fecundating dust, is transferred from the anthers, or pollen-producing organs of the flower, to the stigma, the organ which receives it and transmits the contents of the grains to the rudimentary little seeds. If this transfer of pollen does not take place, the rudimentary seeds do not go on developing, but perish. In some plants this transfer of pollen is brought about by the wind, but in far the greater number of flowering plants, insects are necessary to its accomplishment; for experiments have shown that flowers can seldom be fertilized by their own pollen; they require the pol-

len of some other flower of the same species. If insects are excluded from such plants as require their aid, they produce little or no seed. If the bees and other insects were kept from the flowering orchards, the autumn would see them more destitute of fruit than they have ever been from the attacks of the curculio. The honey and pollen which the insects gather, is of course all that attracts them to the flowers; in fact the special office of the honey is to attract insects that they may bear away the pollen and fertilize the seed. As far as we yet know, only those plants which require insects to fertilize them produce honey. Much yet remains to be learned of the exact way in which fertilization is accomplished in many special cases, but all observations go to show that in the majority of cases insects are necessary to accomplish it.

I trust I have said enough of the beneficial species to prove that we should by no means condemn all insects alike, that, while insects do us an enormous amount of damage, many of them are most useful to the farmer and are even a necessity to him. It is undoubtedly true that in the natural state of any region the injurious species would never increase to the extent to which they do in our cultivated fields. Before man interferes with the vegetation of the country, a great variety of plants grow together in the same region, and any insect, feeding on a particular species of plant, must go about from place to place in search of its particular food plant; and should it increase in numbers, its food plant at once becomes scarce and it must decrease; in the same way the insect and its parasites hold each other in check, and a balance of power is kept up between the insect, food-plant, and parasites.

Having acknowledged that many insects are beneficial, the importance of distinguishing between the injurious and beneficial species is at once apparent. The importance of the farmer himself being able to make this distinction is well illustrated by the mistakes which are constantly made. The ravages of the plant lice, or aphides, are familiar to all of you. The rapidity with which they multiply render them most difficult to combat. They hatch out in the spring from eggs produced by winged parents of the fall before. The spring brood

is composed of wingless individuals all alike, and all producing young like themselves, without the intervention of any males whatever. This remarkable form of multiplication goes on all summer, but in autumn a new brood of winged males and females is produced. When protected from the winter, however, this asexual reproduction goes on for years, no males being produced. This mode of reproduction accounts for the almost incalculable rapidity with which they multiply. Yet their natural enemies are almost always sufficient to keep them within bounds. Minute ichneumons prey upon them, the young of the delicate lace-winged flies devour them, and many of the lady-birds, or lady-bugs, feed upon nothing else during their whole lives. Yet Professor Glover, of the National Department of Agriculture, says, that at the south "Many planters imagine that these lady-birds are in some mysterious manner connected with the appearance of the cotton louse, or even that they are the progenitors of the aphis itself. This erroneous impression is formed in consequence of these insects being always found in similar situations at the same time, and abounding on plants already weakened by the attacks of the plant louse. The sudden disappearance is also accounted for, as, with the decrease of their natural food, the lady-birds also disappear and migrate to neighboring plantations in search of a fresh supply of nutriment. I have actually known several planters who have caused them to be destroyed by their field hands, when and wherever found, and who complained that their plants were still destroyed by the aphis, or cotton louse. This was only to be expected, as they had destroyed the natural enemy of the louse, and suffered the pests themselves to breed in peace and safety."

The lady-birds form a family of beetles by themselves, the *Coccinellidæ*, which are among the most beneficial of insects. Most of them feed upon plant lice, but others attack the chinch bug; but even in this friendly family there is one injurious species. The squash coccinella, as it has been called, *Epilachna borealis*, belonging to a different genus from the carnivorous species, feeds, in the young state, upon the leaves of the pumpkin, squash, etc., and is frequently quite injurious.

The beetle resembles the common lady-birds, but is rather larger than most of them, and the wing covers are light yellow, each marked with seven black spots. The larva is yellow, and armed along the back with rows of branching, thorn-like spines, tipped with black. Instances of this kind are not at all uncommon, and the only remedy is a diffusion of some knowledge of insects among farmers themselves.

A knowledge of insects is also necessary to the farmer for quite another reason. Take up almost any of our agricultural journals, and you seldom fail to find prescriptions vouched by somebody to be unfailing preventives of the ravages of some particular insect, or even for all the insects which attack a given plant. All sorts of patent and other machines and nostrums are advertised, recommended, and too many, even, sold through the country. Nine-tenths of these machines, nostrums, and prescriptions, are utterly useless and worthless. Not that the correspondents of the journals and the inventors intentionally falsify; knowing nothing of the structure or habits of insects, they jump at some conclusion on insufficient observation, and, having formed an opinion, they hold fast to it in the face of all reason. In the majority of these cases even a very rudimentary knowledge of entomology would convince any one of the worthlessness of the remedies. A crop of some farmer is attacked by insects, no matter what they may be or what their habits, he applies lime, salt, ashes, or saw-dust, and in due time the insects disappear, the natural time for them to go into the ground to transform having arrived, or some of their natural enemies having swept them off, and at once he concludes that his remedy has done the work, and it is heralded abroad as a true specific. I can recall a dozen of the most absurd remedies for the borers in fruit trees, most of them the boring in the trees of holes ten times bigger than the borers themselves ever made, and filling them with all sorts of substances, no two of the doctors agreeing as to what.

The female of the canker-worm is wingless, and consequently obliged to crawl up the tree-trunks to deposit her eggs; so if any means are taken, by applications to the trunk

or otherwise, to prevent them, and the young worms also, from ascending the trees, their ravages are stopped. But, a few years, ago the same remedies were proposed, and quite extensively tried, to protect fruit trees from the curculio, the females of which a moment's observation would have shown to be flying insects, not to be stopped by any application to the trunks of the trees.

In 1866 an agricultural paper in Maryland came out with an editorial calling particular attention to a great discovery for destroying the Hessian fly, the discoverer proposing to sell the right of using his method of preventing the attacks of this insect to each county for $100. The whole theory of the remedy was based on the false supposition that the Hessian fly deposits its eggs upon the grain in the ear of the wheat in midsummer, a time when the Hessian fly never appears in the winged state. The discoverer makes other statements, showing plainly that he knows nothing of the structure or habits of the Hessian fly. Mr. Walsh accounts for some of these statements by supposing, with considerable reason, that the discoverer of this wonderful remedy has mistaken one of the parasites of the Hessian fly for that insect itself, thus confusing his best friend with his worst enemy.

Such examples might be recounted by the hundred, all of them presupposing the densest ignorance of the best known facts in regard to the structure and habits of common insects. Not only would a rudimentary knowledge of insects save the farmer money and labor wasted on useless remedies; it would frequently show him what the extent of the damage insects were doing was likely to be, or how long their ravages were likely to continue, and whether preventive measures would pay if tried. It would show that when the enemies of the plant lice, for instance, were getting the better of them, that interference was unnecessary.

I will occupy but a few moments with suggestions of what seem to me the best way of directing the efforts of the Board, and others interested, with reference to this whole subject. First the agricultural community must be brought to appreciate the necessity of a knowledge of insects in general and

of the importance of minute, careful, and thorough investigation into the structure, habits, and economy of the common species. Most investigations in natural history, as in many other branches of science, are made without any direct reference to their practical value, and hence we are too apt to regard them as of no importance to the so-called practical man. Yet if it were not for this groundwork of purely scientific knowledge, the attempts to apply science to agriculture would be useless. Even the scientific entomologists are acquainted with only a fraction of the species of our New England insects, and only the very smallest fraction of these are known in more than one of their stages. The farmer can aid these investigations in many ways, by his own observations and by preserving specimens of those insects which seem most injurious or beneficial. Insects frequently attack and severely injure some crop for a whole season, without any entomologist seeing a specimen or being able to determine what it is—which of fifty thousand different bugs it may be—and simply because no one was enough interested or thought it of enough importance to save specimens for examination.

And specially should children be encouraged to observe and study insects and other animals. Aside from the knowledge they acquire, the cultivation of the powers of observation and discrimination, which are so important in all the practical operations of life, amply repay all the expenditure of time and trouble. While the whole study of animals, in all its departments, is neglected in our schools, and teachers are as ignorant on the subject as their pupils, we can expect little knowledge of insects among farmers. Botany is now taught in many of our schools, and its importance as a branch of study is beginning to be recognized on every hand. Why should we neglect the even more important study of animals? Most children are naturally inquisitive and at once take an interest in such things and very little encouragement is needed. Much also may be done by the distribution of information through the published reports of the Board. Some portion of the time of these meetings could be devoted profitably to discussions in regard to injurious species, and valuable in-

formation would doubtless be brought out in that way, and especially if the insects themselves were brought forward for examination. There is quite as much necessity for the dissemination of the knowledge which we already have, as for the acquisition of that which is new—however important that may be. The want of good works on our common injurious and beneficial insects is one of the principal difficulties in our way. In Europe, where the country is densely populated and all the products of the soil higher priced than here, the ravages of insects are more severely felt, and yet, from the greater care taken to protect crops, they are not so destructive as in this country. But in Europe the application of entomological knowledge has received far more attention than here, and many large works, prepared with great labor and fully-illustrated, have been published at government expense. And in Germany the subject is taught in the schools and colleges.

In our our own country the best works are Dr. Harris's "Treatise on some of the Insects Injurious to Vegetation," of which three editions have been published by the State of Massachusetts, the last edition of which is well illustrated; and Dr. Packard's "Guide to the Study of Insects," the only general work on insects published in this country, and one which should be in the hands of every one interested in any way in the study. Other treatises are scattered through government reports, the publications of agricultural societies, agricultural journals, etc. The Practical Entomologist, two volumes published at Philadelphia, 1865 to 1867, and the American Entomologist, also two volumes, published at St. Louis, are two small monthly journals, now suspended, which were devoted exclusively to practical entomology, as it is called, and which are still valuable, as they contain many good figures and much information in regard to noxious insects. Dr. Fitch's Reports on the Noxious and Beneficial Insects of New York, Mr. Riley's Reports on the Noxious, Beneficial and other Insects of Missouri, and Prof. Glover's papers in the national agricultural reports, are other works which

can be consulted to advantage. I mention these works specially because the literature on this subject in this country is not well enough known to those interested.

In resisting the attacks of injurious insects, much might undoubtedly be done by intelligent legislation. Allow me to quote Dr. Packard on this point. He says: "As illustrated so well by the history of the incursions of the army-worm and canker-worm, it is only by a combination between farmers and orchardists that these and other pests can be kept under. The matter can be best reached by legislation. We have fish and game laws, why should we not have an insect law. Why should we not frame a law providing that farmers, and all owning a garden or orchard, should co-operate in taking preventative measures against injurious insects, such as the early or late planting of cereals, to avert the attacks of the wheat midge and Hessian fly; the burning of stubble in the autumn and spring, to destroy the joint-worm; the combined use of proper remedies against the canker-worm, the various cutworms, and other noxious caterpillers?" We have already some laws protecting small birds, but they need to be more stringent and better enforced. Legislation on the subject can scarcely be expected and would be perhaps of little use, until the necessity for it is better appreciated than it is at present. Having alluded to the usefulness of a knowledge of entomology, and, in a general way, to its relation to agriculture, I wish, in the time which is left us, to call special attention to three or four injurious insects which have recently appeared and are likely to do much damage, so that their habits may be observed the coming summer, and also that any gentleman present, who have already encountered them, may give us the results of their observations.

The first of these is the corn weevil (*Sphenophorus Zeæ Walsh*) which attacks the stalks of young corn in June. It is a slender, subcylindrical, blackish beetle about three-eighths of an inch long, excluding the slender snout, or beak, which is nearly a third as long. The beak is black, curved downward, not bigger round than the basal part of the legs, and has at its base a pair of slender antennæ which are black,

with the extremity of the knob at the end whitish. Before the middle of the thorax there is a polished diamond-shaped space, surrounded by grayish punctures. The wing covers are marked with longitudinal rows of still larger, grayish punctures. It seems to have been first described by Mr. Walsh, in The Practical Entomologist for August and September, 1867. It has done much injury in New York state, and has already appeared in Connecticut and Massachusetts. Very little is positively known of its habits. Mr. Walsh supposes that in the larva state it lives in moist wood situated in places where it is constantly washed by water. The specimens which I exhibit, however, were brought to me by a gentleman from Guilford, whose corn had been severely injured by them, and who said the fields attacked were far from any water, but a part of his own field had been dressed with chip manure in which the larvæ might have lived if they really feed upon decaying wood.

It is quite likely, however, that Mr. Walsh was mistaken in regard to its habits, for there is another species of the same genus which is said to have a very different habit in the larva state, although the perfect insect attacks corn in much the same way. Of this last species, Prof. Glover* says that it is very destructive to corn in many parts of the South and Southwest, and in regard to its habits, quotes the following statement of Senator Evans. "The perfect insect eats into the stalk of the corn, either below or just at the surface of the ground, where it deposits its egg. After changing into a grub, the insect remains in the stalk, devouring the substance, until it transforms into the pupa state, which occurs in the same cavity in the stalk occupied by the grub. It makes its appearance in the following spring in the perfect state, again to deposit its eggs at the foot of the young corn plants. These insects destroy the main stem, or shoots, thus causing suckers to spring up, which usually produce no grain, or, if any, of very inferior quality to that of the general yield. Swamp land or low grounds are the places most generally attacked."

*Agricultural Report of the U. S. Patent Office for 1854, p. 67.

It is also said that this insect is very destructive in Alabama, and on Red River in Arkansas, but that the planters have greatly diminished its numbers by pulling up the roots of the corn after the crop has been harvested, piling them in heaps, and burning the whole mass.

Now does our corn weevil have the same habits in the larva state as this southern species? This question must be answered before we can propose any remedy for its attacks. This point is readily determined by watching the weevil wherever it appears next summer. If it agrees in habits with its southern relative, it can be destroyed in the same way. If, on the other hand, it lives in the larva state in chip manure, or decaying wood, these substances must be removed, or at least not used for dressing.

The other weevil is a species which attacks the bean. It closely resembles the pea weevil and might readily be mistaken for it, but is really a different species, the *Brachus obsoletus* of Say. This bean weevil probably deposits its eggs in the pods of the bean while quite young and tender, in the same manner as the pea weevil does; of the pea weevil, however, there is usually only one grub to a pea so the germ is not destroyed, while a dozen grubs of the bean weevil are frequently found in a single bean, so that those attacked are more than half eaten up and few if any of them can ever germinate. The damage done by the bean weevil is therefore much greater than that which the pea weevil accomplishes. This bean weevil was obtained a long time ago by Say from the seeds of a wild plant allied to the beans and peas, but was not known to attack cultivated beans until recently. Within a few years it has attacked cultivated beans, and has done much damage in Pennsylvania and New York. This year it has appeared about New Haven. How long it has been in this state I am not aware. The same remedies should be used against this as against the pea weevil. The presence of the weevil is readily detected by the transparent spots made by the larvæ, and on no account should beans which contain them be planted.

The other beetles exhibited are two of those which attack

the potato. The smaller one, which is cream color with three black stripes on the wing covers and looks very much like the common striped cucumber beetle, but is larger and stouter, is the species which has been common in New England for many years but is not usually abundant enough to destroy the crop. The larger, short, oval species with ten black lines placed longitudinally on the wing covers, is the western, or Colorado potato beetle, which for a few years past has almost destroyed the potato crop at the west. It is rapidly spreading eastward and there is no telling how soon it may be among us. It is important to distinguish between these two beetles, for it has several times been stated that the western species was already found in the eastern states, the observers mistaking the common small species for the far more destructive species of the west.

DR. RIGGS.—I have noticed on my plants, and on the tender shoots of my apple trees, this green plant louse in quite large numbers; and I have noticed small, brown-colored ants, running around among these lice. Are they destroying the lice, or do they live on the exudations or secretions of the body of the louse?

MR. SMITH.—If you notice these lice, and especially if you examine them with a magnifying glass, you will see that they exude, from two little tubes at the posterior part of the body, a sweetish substance, which is sometimes called "honey dew." This frequently drops on the leaves. The ants are very fond of it, and climb up the trees or other plants and feed upon it. The ants never eat the aphis, that I know of.

DR. RIGGS.—I have seen it stated that the worm which feeds on potatoes is the same kind that feeds on tobacco.

MR. SMITH. I know that is a very common idea, but probably erroneous. At least there are two quite similar but distinct species, one of which usually feeds upon the potato and tomato vines, the other upon tobacco and also on the tomato. The potato worm has the oblique stripes on the sides of the body greenish yellow, and the feet and the horn upon the end of the body black, while in the tobacco worm the oblique stripes are white, and edged above with bluish and short trans-

verse black lines, and the feet white, ringed with black. The moths which come from these two worms are also different, though looking much alike. It is possible that both these species sometimes feed upon tobacco or upon the potato, as they both do upon the tomato, but this is not usually the case.

Mr. Robinson.—I would like to have the professor describe the egg of the canker-worm, and tell us whereabouts in a tree it is generally to be found.

Mr. Smith.—Usually, if the females can get up the trees, they will go up among the branches, but very frequently they deposit their eggs on the sides of buildings, on fences, and especially just below any protection that has been put round the trees to prevent their going up. The eggs are very small, slightly elongated, and are placed close together on end in little patches, the eggs all glued to each other and to the bark, or whatever they are upon, by a varnish which the mother moth secretes. If you wish to see the eggs, all you have to do is to catch two or three of the females when they are coming out of the ground, and shut them up in a box, and in the course of two or three days you will have an abundance of eggs.

Dr. Riggs.—Ten years ago, on a farm in Bloomfield that I owned, I had a potato field covered with a most disgusting sort of bug. I never had it before, and I have never had it since. They were absolutely nauseating, their whole bodies being covered with mucus, and so offensive that I could not bear to go through the potato rows. They covered the whole field, of about an acre, and ate the vines up, so that the crop was almost a failure. They were about the size of the small potato-bug which the professor has exhibited, but there was no shell upon their backs. It was a glutinous mass, that seemed to have legs sticking out of it, and the exudation from their body was a jelly-like substance, exceedingly offensive, and disgusting to handle. If you took one in your hand it would slime it all over.

Mr. White, of Putnam.—I have seen that kind of insect more or less on my potatoes for ten or fifteen years. They were quite plenty this year. I have sometimes had a great

many hills nearly eaten up by them. I never handled one. They looked so nasty that I thought if I took one up it would come all to pieces.

I have also had on my potatoes, and perhaps more last year than usual, a bug that is square in shape, with corners sticking out. It is quite impossible to tell which is the front and which the back side. What those are I do not know.

I also have another bug, which plagues me more than any thing else, especially on the Davis Seedling. They eat up the vines entirely clean if I do not have a large piece. It is a striped bug, about as heavy again as the common bug that eats down our cucumbers, and the stripes are of a little darker color.

MR. SMITH.—This striped beetle is the one that has been mistaken for the western potato beetle so often, and the disgusting worm or bug is the larva or grub of the same insect.

MR. WHITE.—I presume so. I get rid of these three bugs in this way. As soon as I discover them I take plaster of Paris and go over my field when the dew is on and sprinkle it on the vines. The application of the plaster once or twice prevents their doing much injury.

PROFESSOR JOHNSON.—You have all read the advertisement of the Grafton fertilizer. The owners of a quarry in New Hampshire, originally worked as a gold mine, failing to make their excavation pay by the yield of gold, have found they can make it pay better by grinding the rock and selling it as a fertilizer. It is carbonate of lime and magnesia chiefly. According to the owners they have certificates of its wonderful fertilizing effects; and also (what is very remarkable) that it is a specific against insects of all kinds. I had seen the advertisement of this fertilizer; it struck me as rather curious, and it occurred to me that I had met with some facts which might assist me in finding an explanation. About the time I thought of it a relative of mine from Northern New York paid me a visit. I had a few plants in my garden, the tops of which had been nearly eaten up by these little plant lice. I rather admire to see them work, especially when I see the ants come up and milk them. You know entomologists say that

the ants make butter, and these lice are the ants' cows. I was in the garden one day with my friend, watching these insects, and he told me that he had two or three acres of land in the village where he lived, and one year he set out a lot of cabbage plants. They grew famously for some time, but one day he looked at them and saw that they were covered with lice. The next day he looked at them again, and they were evidently increasing with marvellous rapidity. "I thought," said he, "that my cabbage plants were gone, and I felt so mad that I took up a handful of dirt and slung it at those things. It seemed to relieve my feelings, and I went through the whole row, flinging the dirt upon the plants, and then went into the house. The next morning I was out looking at them, and I noticed that where I had slung the dirt they seemed to have let up a little. That rather encouraged me, and I went through the whole piece in the same way. I got up every morning for a week, and went out and sprinkled dirt on the plants when the dew was on them, and I had a splendid lot of cabbages. My neighbors asked me 'How in wonder did you get those cabbages? What have you been doing to kill those fellows?'" Here we have the explanation of it. You may take coal ashes, or plaster, or Scotch snuff, or any kind of dust, and it will have the same effect. I have no doubt Mr. Smith will tell you that the reason why these things destroy the insects is, that the dust chokes them up.

A neighbor of mine in the city, who had a large garden, which was the admiration of every body, employed a very skillful gardener, who, in the spring, when his cabbage plants got up to a certain height, would go through the rows and sprinkle plaster or ashes upon them, and his plants were not troubled by the aphis. I presume mine would not be if I had done the same thing, but I like to give the insects a fair chance on my farm.

Dr. Riggs. The cabbage raisers near me have a remedy for the green worms that infest the cabbage plant; it is salt. One man had set out three-quarters of an acre with cabbage plants which began to be infested by these green worms, and he sprinkled a little fine salt on the head of each cabbage, or

on the leaves before they began to gather into heads. He said it not only killed the worms, but helped the leaves to fold one upon the other, and make good heads. I suggested to him that a solution of salt would do better. He seemed to know nothing about that, but he knew that sprinkling salt over the heads two or three times in the season would protect them from worms, and so he applied it in that way. I have never used it, but I intend to do so.

MR. DAY. I should like to have Prof. Smith give the reason why dust kills these worms, as Prof. Johnson has suggested.

MR. GOLD. And at the same time take some little notice of that foul-looking worm or bug.

MR. SMITH. This foul-looking worm which several gentlemen have described in somewhat different ways, is the young of the striped potato-beetle. Perhaps I should have described its habits more particularly. The beetle was well described (by Mr. White) as a little bigger than the cucumber-beetle, and with the stripes a little darker. The foul-looking worm which the same gentleman mentioned was the young of the same insect. The different stages of this beetle are by far the commonest insects on the potato in New England. The beetles come out of the ground the last of May or early in June and at once attack the leaves of the potato, usually collecting among the young leaves at the top of the vines. When taken between the fingers they make a creaking sound. The females soon lay their eggs, which are oval, bright yellow, and glued to the leaves in little clusters of half a dozen or so. The little grubs, which are soon hatched from these eggs, grow rapidly and devour the leaves. They are rather short and thick and have a pair of legs on each of the first three rings of the body. After eating the leaves they cover themselves with their own excrement. The anus is on the upper side of the last ring of the body, and as the excrement is expelled and falls upon the back of the grub, it is pushed forward by the motion of the body till the whole back is covered with a filthy mass, which undoubtedly protects their soft bodies from their enemies. They always move backward while eating, devour-

ing the edge of the leaf under their heads as they go. When full grown, they crawl down the plants and go into the ground, where they change to pupæ, and finally to perfect beetles, which come out in August and produce a second brood of larvæ, which go into the ground for the winter.

In regard to the effect of dust on any insect, it is very important to know that insects breathe, not through the mouth, as children think they do, but through openings in the sides of the body. If you take a tobacco worm, or a grasshopper, or any large insect, you will notice on each side of most of the rings of the body, a little spot which is frequently of a different color from the surrounding parts, and if these spots are carefully examined, a little hole will be noticed in each. These holes connect with tubes which branch all through the body. These different openings along the body are connected together inside, so there is a perfect network of air tubes throughout the interior of an insect, somewhat as the veins and arteries run through our bodies, but the blood of an insect is not brought round to any special place to be affected by the air; the air penetrates all through these tubes to aerate the blood. Any fine powder applied to many kinds of insects, especially when they or the plants they are on are wet, may stop up these openings and so suffocate the insects.

If these openings, called breathing-pores, or spiracles, are stopped up, by touching them with a little oil or varnish, for instance, the insect soon dies. In killing insects with any liquid, as benzine or chloroform, the application is more effective if made along the sides of the body than upon the head, as is frequently done. Fine powder or dust undoubtedly acts beneficially quite as often by obstructing the motions of insects; they become covered with the substance and roll off the plants on to the ground.

Capt. Danielson. This is a subject comparatively new to us. I see the vast importance of it, and am very glad that I happen to be here. I think we have men here who will be able to give us a great deal of light. I have lived longer than most men here, and our crops seem to be infested, especially our garden crops, with more insects and worms than

when I was a boy. I want to know whether they are new creations or a new development of creatures that existed years ago. We do not know what to make of it, and we get irritated over the matter. We go into our gardens sometimes in the middle of a very hot day and we find our cucumber plants all cut down and the leaves lying on the ground and drying up. This ought not so to be. I was conversing with an aged man a few years since, who said he distinctly remembered when there was no such thing as a rose bug; now, they sometimes come in such clouds that we can hardly see. I should like to know whether entomology can explain this, or is it because our soil has been worked over so long that it is bringing up insects that did not exist there years ago. I see the very great importance of this subject, and want to get more light upon it. If we can go to work and kill off these insects by millions, it would be a great benefit to us.

Mr. Gould. I do not think that there is any evidence of a new creation of insects. Almost all the insects which have infested this country have been directly traceable to importations from abroad. The origin of the Hessian fly is well known. It was brought over here in straw by the Hessian troops at the opening of the Revolutionary War. Prof. Smith has said, very correctly, that four or five years ago there were no parasites of the wheat midge known in this country. The history of that insect is exceedingly interesting, and perhaps will illustrate the point which the gentleman inquires about.

The wheat midge made its first appearance on this side the ocean in 1830, in Canada, and it was found on investigation, to have come from the emptying of a straw bed which was brought over by a Scotch emigrant. From that time it spread in a circle of about thirty miles a year until it has embraced nearly the whole of the wheat region. The elderly gentlemen here will recollect the time when their wives and mothers would ordinarily make rye and Indian bread for the family, but when the minister or the schoolmaster was coming to tea, they felt it to be their duty to have a barrel of Troy City

flour in the house. The old housewives did not believe that any other bread than that made from Troy City flour was the thing to entertain great folks with when they came. That Troy City flour had a reputation all over the country. Its sale was enormous. The number of mills in Troy was astonishing. It was supposed at the time that the prosperity of the city of Troy depended entirely upon those flour mills. Then, sir, the wheat that supplied the city of Troy was grown in the counties of Washington, Rensselaer, Albany, Montgomery, Schenectady, Columbia, Green, Schoharie, and some other counties around them. That was the region where the principal part of the flour made in the United States at that time was manufactured. But after the introduction of the wheat midge the growth of wheat in those counties, once so celebrated, was utterly and entirely destroyed. In the counties I have enumerated there is not now raised one-tenth part of the wheat necessary to supply the inhabitants of those counties.

The wheat midge is exceedingly small. I was the third man on the face of the earth, I believe, who ever saw a male wheat midge. It is the most minute insect that I know of. The only way to examine it is to hold a candle near it and allow its shadow to fall; you can then get some idea of it. That wheat midge was first seen by a German Entomologist; then, for nearly forty years, it was never seen again. Within a few years, Dr. Fitch found a male wheat midge; I happened to visit him the day after he found it, and I was the third man who ever saw a male wheat midge. I doubt if there are thirty men who have ever seen a male wheat midge up to this time. But what I was coming at was this, and it is a very curious fact. When the British people heard of this terrible invasion among the wheat crops of this country, an Order in Council was drawn up and passed by the Privy Council of England, ordaining that no American wheat should, under any circumstances, be imported into any British port. After the Order had been passed, but before it had been promulgated, it was submitted to Mr. Curtis, who stands at the head of the entomologists of Great Britain, and is very well

known to Prof. Smith, to ascertain whether the technical terms used in the Order in Council were correct. He replied that technically, the terms of the Order were all strictly accurate, but he informed the clerk of the Privy Council, who brought him the paper, that it was a perfectly useless piece of legislation; that the Americans got the wheat midge from England, and that there was no more danger from the introduction of American wheat than from the introduction of Scotch wheat. When that information was given to them, they repealed the Order, and it was never promulgated; but that is the historical fact. Why, then, is the wheat midge so destructive in America, when it is not in Great Britain? It is because, in Great Britain, there are a great many parasites that prey upon it; as soon as one alights, a parasite is ready to stick in its ovipositor and deposit its egg, which, when it is hatched, destroys it utterly. That is the reason why it has never done any damage there. As soon as that was known, efforts were made by Dr. Fitch, especially, to secure some of these parasites. He wrote to his scientific friends in Europe to send out to him these parasitic insects which prey upon the wheat midge, and innumerable bottles of eggs and insects of every kind were sent out, but it was found utterly impossible to get them across the ocean alive. But a year or two ago, Dr. Fitch informed me that he believed the parasites had arrived, for he has found the insects destroyed by something, and it is believed that in some accidental way the European parasites have escaped from Great Britain and arrived in this country. If so, the ravages of the wheat midge will be prevented.

In Great Britain, and in almost all parts of Europe, there is a beetle well known as the asparagus beetle. The devastations are so marked, that it is only with the greatest difficulty that European gardeners can raise asparagus. Up to the year 1863 or '64, it was unknown here. Most of you know what a great business the raising of asparagus is on Long Island. Many men have a hundred acres in asparagus, and nothing else. All at once, to the utter astonishment of every one, clouds of these asparagus beetles made their ap-

pearance on Long Island, and there was perfect agony on the part of the Long Islanders. Dr. Fitch was sent for, and upon making an examination of the ground, he found the remains of these beetles. Continuing his investigations, he found that the skunks were eating the asparagus beetles whenever they found them; there was nothing they seemed to enjoy so well. He then, from the analogies of the case, suggested that it was very possible that hens might destroy them, and by his advice, the gardeners on Long Island turned their hens into their asparagus fields, and the consequence is, these beetles do very little damage.

I will state a single other fact, for I will not take up too much time. There is a sort of aphis which, until some years ago, was entirely unknown in this country. It is of an orange color, and much larger than the ordinary green aphis. I had never seen one in my life, and I do not believe any man in America had seen one, although I was perfectly familiar with the insect from the beautifully colored plate of Mr. Curtis, and recognized it at once when I did see it. I had been in the Adirondack woods for some time, and knew nothing of what was going on in this part of the world, and on coming out of the woods, I spent a few days in North Elba, going through a field of wheat there, on the farm which belonged to John Brown, whose soul is now "marching on." I was impressed with the idea that I had never seen a field that was so utterly rusted in my life. Drawing one of the heads down, and examining it through my glass, I found that it was no rust at all, but it was this identical yellow aphis, that I had never dreamed was to be found in America. It was a perfect mystery to me where they came from. I asked the hunters around North Elba if they had ever seen this aphis; they said, No, it was entirely new; they all thought it was the rust until I called their attention to it. When I returned home, I asked if they had seen any strange aphis? Yes, they said, in 1864, the whole wheat crop had been destroyed. The next year I watched very carefully, and I found it made its appearance occasionally, but I found also an enormously developed red bug, which preyed upon it. There was no

other species of red bug that I saw except this one—a two-spotted red bug. The second year, there was very little damage done. The third year, these things had entirely disappeared. Now, somebody had imported that, and since, as Prof. Smith says, the mother of one of these lice that is born in the morning will be a grandmother before night; you see how rapidly they increase. A single year was sufficient, not only to develop them all over the cultivated portion of the United States, but to send them away up into the farthest recesses of the Adirondacks. This illustrates how easily they are imported. If the parasite happens to be imported with them, we see very little of them. Sometimes a peculiar concurrence of circumstances will take place by which the parasite is destroyed; then insects which have not been seen for years will appear in great numbers, and will be the destruction of certain kinds of crops upon which they prey.

I do not know whether you have ever investigated a worm called the forest worm. It resembles the canker worm somewhat, still more the apple worm. The peculiarity of this forest worm is, that it has notes of exclamation on the back. Commonly, you will see very little of this worm, but once in a while, all the maple leaves will be cut off by its operations. There is a parasite which preys upon it, and when no circumstance occurs which destroys this parasite, the forest worm is kept under, and you know nothing about it; but if the parasite should be destroyed, you will find no end of maple trees in the woods killed by the operations of this worm.

Before I sit down, I want to tell a Munchausen story. I am sure that my credit as a man of veracity will be utterly destroyed when I give it, but it is well vouched for by official documents in India. There was at one time a development of the grasshopper in India that was beyond all calculation and beyond all belief. The whole heavens were darkened with it, and so enormously thick was this storm of grasshoppers that the sun did not shine through them. Well, a furious wind occurred very shortly after this, and dashed them against mountain. An examination by government officers showed that there was a pile of these grasshoppers seventy miles in

length, eight feet high, and some forty feet thick at the base. The putrefaction of this mountain of grasshoppers caused a terrible visitation of typhoid fever in India. The whole thing is described in the official documents of India, and I must confess that I am credulous enough to believe it. You can do as you please with regard to it.

One word with regard to the necessity of farmers discriminating, as Prof. Smith has very properly said, between their enemies and their friends. The value of insects as fertilizers of plants cannot be overestimated. Those of you who have never investigated the subject may perhaps be surprised when I tell you, what is admitted I believe, by all scientific men who have turned their attention to it,—that our crop of red clover seed depends upon what, in common language is called the "bumble bee." If the "bumble-bee" cannot work among the clover, it is not fertilized, and clover seed cannot be made. The "bumble-bee" is the very best friend of the farmer, where clover is cultivated for its seed. It is astonishing what Providence has done, in the adaptation of insects and birds to the exigencies of plants, with reference to their propagation. There is a beautiful species of orchid growing in a limited district of South America, the pistils and stamens of which are separated from each other by a very considerable interval, and both of them are in the same horizontal line. The question is, how that pollen shall be scattered so as to fertilize the pistil, in order to propagate the seeds of the plant. This orchid is very peculiar. There is a tube over the pistil and a tube over the stamen. The tube over the stamen is a contorted tube, so that you cannot push a straight stick through it. Now, there is a humming bird, known only to South America, known only in the district where this orchid is cultivated, that has a bill which is contorted, and the contortion is such as exactly to coincide with the contortion of the tube of the plant. The effect is, that this humming bird can only obtain its subsistence in the country where this orchid grows. His crooked bill is inserted into the crooked tube, and in shaking about the stamen of the orchid, in order to obtain the honey which lies at its root, he fertilizes the pistil.

These are merely samples of the great benefit which results to us from the operations of insects. It seems to me that there is no duty which should impress itself more strongly upon farmers than this of learning how to discriminate between their friends and their foes. I might relate to you many instances where the greatest injury has been done in consequence of farmers murdering their friends, simply because they do not understand this distinction, and it is high time that more attention was paid to this matter.

Dr. Riggs. There is one protection against this red-legged grasshopper which the Professor did not mention, and that is, the common domestic turkey. They will destroy the grasshoppers in great numbers. This last season, I experienced considerable benefit from two flocks of turkeys, owned by neighbors, that I have generally considered rather as nuisances. They devoured immense quantities of grasshoppers on the edges of my tobacco and corn fields; in fact, they lived on them. I intend to raise a large brood of them next year, in self-defence.

Mr. Smith. Although it is getting late, I would like to answer two or three questions which have been asked. The question in regard to "new creations of insects," partially answered by Mr. Gould, perhaps deserves more notice. There is not the slightest foundation for the belief that there are ever at the present time new creations of insects. The talk about spontaneous generation, protoplasm, the origin of life, etc., which is so common just now, may help to revive this old idea of creations of insects, but no one among the scientific men of to day, however strongly he may believe in spontaneous generation, or any theory of the origin of life, supposes for a moment that insects ever originate directly in that way. The organisms which some suppose to be produced in this way, are far lower in the scale of organized beings than any insects,—more different from insects in fact than insects are from man. Every insect is produced from some other similar individual of the same species. What I have already said in regard to the sudden appearance of the canker worm and other insects will explain many facts of the sudden ap-

pearance of species of insects not before known. We should constantly bear in mind the vast numbers of different kinds of insects which everywhere exist and yet are almost or quite unnoticed by most people. Entomologists are acquainted with many thousands of different kinds of insects, from our own country, which are probably never noticed by the farmer, and yet the entomologists know only a part of the species which really exist. If, in the latter part of summer or early in the autumn, you sweep a deep net made of fine cloth through tall grass, grain, or any plants, you will be surprised to see what a vast number of small insects of hundreds of different kinds will be found in the net, and if the operation is repeated all day different kinds will constantly be found.

The "bug" which was mentioned as found on potato vines with the different stages of the little striped beetle, and described as having corners sticking out so that it was impossible to tell which was the front and which the back side, must be one of the tree-hoppers, which are allied to the Cicadas, or harvest flies, and have somewhat similar habits. There are a great many kinds of them; some of the common ones shaped like beech nuts, others more slender and without sharp corners. They all have similar habits in the adult state, piercing with their beaks the plants upon which they live and sucking the juices. They are all more or less injurious and some of them do much damage.

Permit me again to urge the importance of preserving specimens of insects for examination. I shall always be very glad to do all I can to give any one information in regard to the insects which are met with by farmers or other people. Specimens might be brought to the meetings of the Board, or still better, sent to me at New Haven. Insects may readily be sent by mail, putting them in a small paper box, enclosed in a letter. Any such letters of inquiry I shall be happy to answer as far as I may be able.

PROF. JOHNSON. I congratulate the Board of Agriculture on having gotten Mr. Smith interested in behalf of the farmers of Connecticut on this subject. To be sure, he hails from the same place that I do, and is connected with the same

institution that I am, and therefore you might say that I have no business to get up here and praise him. But I will tell you one thing,—if he was not a first rate man, I know he would not hail from there. I want to tell you another thing: we have lately had to raise his salary to keep him from accepting a permanent position in another institution, and if he had not loved us better than he did a more lucrative position he would have gone. I mention this to show you that the best authorities in the country understand that he is a very promising entomologist, a thing we have known down in New Haven for a number of years, and I want the State Board of Agriculture, and the farmers of Connecticut to put their finger down upon this proposition, that neither Massachusetts, nor any other state shall be able to take Mr. Smith away from us. If we need any more money to keep him, I want them to come forward and help us pay him.

There is one other point to which I wish to refer. We cannot spread intelligence abroad in the community with reference to insects unless we will take a little trouble. In the first place, we must know what insects are. We must learn that "bug" is not a name which describes all insects. We must learn the different kinds of insects, and their transformations, so that we can talk about them intelligently. Suppose I talk Greek, and you talk Latin, and my neighbor talks German; if we all got together, we should not make much headway, because we could not talk intelligibly. We must know the language which serves to describe insects, in order to converse together intelligently in regard to them. Now, I want to suggest, that when your Agricultural Societies offer their premiums this year, instead of saying "For the best crop of corn, $2.00; for the second best, $1.00," and so on, they offer a copy of Harris's "Insects Injurious to Vegetation," or, what would perhaps be better, Dr. Packard's "Guide to the Study of Insects." They are illustrated, they give all this information with regard to insects, they describe, more or less particularly, the chief injurious and useful insects, and in that way at the cost of a few dollars, you can scatter around, in many of your farm houses, the sources of inform-

ation on this subject in which some bright boy or girl will be interested, (and girls can do this work just as well as boys,) and you will have growing up among you persons familiar with all these things.

Another point. Offer a premium in money—a good round one—make it twenty-five or fifty dollars—for the best collection of useful and injurious insects, showing their different stages, properly labeled, with the scientific and common names, to become the property of the Society, and you can put it in some school like this, or in some place where it can be made serviceable, so that all who get an insect may know where to come to find the name of it, and to get some notion in regard to its character. Put that collection in the care of some school-teacher, or some person, lady or gentleman, girl or boy, who will take an interest in the subject, so that it will be a sort of centre of information, and stimulate persons to cultivate the habit of looking at these things. If you will do this, in twenty-five years, if they will not do it anywhere else, you will be the centre of information to all the surrounding country, and people will come here to learn about these things. But if you do it, it will be done elsewhere, and we shall all get along nicely together.

One word more. I will say, that probably the best material for killing insects is slacked lime, which is not only a very fine powder, but it is a thing which, if it touches a soft insect, like a slug, is sure death, because of its caustic property. That will beat the Grafton fertilizer.

Adjourned to two o'clock.

AFTERNOON SESSION.

The closing session of the Board opened soon after two o'clock, Mr. Geo. Sanger, of Canterbury, in the chair.

MR. DAY, of Brooklyn offered the following:

STATE BOARD OF AGRICULTURE.
DANIELSONVILLE, Jan. 12th, 1872.

Voted, That the members of the Connecticut Board of Agriculture tender their warmest thanks to Prof. S. I. SMITH, for his very instructive and valuable entomological address, and hope that the farmers of this State will heed his suggestions, and render him every assistance in their power in his investigations of a subject so intimately connected with their interest and prosperity.

Carried unanimously.

FARM EXPERIENCE FOR 1871.

MR. GOLD. Every farmer has doubtless observed, during the year, some facts that would be valuable to others if they were made known. He has seen some things which he was unable to explain, and it is desirable, as we are met together here in conference, that we should bring out from our stores of experience, such points as may be useful to our brother farmers. It was with that object in view that this topic was placed upon the programme. Doubtless some one will be able to answer, more or less directly, such questions as may be asked upon the subjects connected with our farming operations. Nothing connected with our farm management, either in its successes or failures, can be ruled out of order, in the discussion which it is expected will take place under this head.

MR. WHITE, of Putnam. I wish to make a little statement of some experiments which I tried last year, in connection

with some which I made the year previous. I planted a piece of corn in 1870, on some yellow, loamy land, and manured it very well. By the side of this, on the same kind of land, I had a piece of sowed corn, manured not quite so well; and by the side of the sowed corn I had three-quarters of an acre of Norfolk turnips. Last year, I planted all this ground to corn, and also broke up a piece of sward land by the side of it. My object in doing this was to see the effect of preceding crops upon the following crops, and I endeavored to manure the land all alike, except the plaster and the turnips had the most stable manure. The corn was the lightest on the sward ground; the next larger was on the piece where I had corn the previous year; the best was on the ground where I had sowed corn and where I had turnips. I could not see that there was much difference between these two pieces. Now I will state the difference in my mode of management. In 1870, I sowed plaster where I sowed the corn, and mixed plaster with green manure for the turnips, which I covered with the plow before I planted the turnips. Last year, I manured principally in the hill, with green barn manure, or green hog manure, but put on a compost of ashes, lime and plaster, at the rate of about five bushels of ashes to a hundred lbs. of plaster and half a bushel of dry slacked lime. I put about a spoonful of this compost in a hill. I saw no difference in the crop where I used the different kinds of manure, but where I used plaster the previous year, the ears were almost as large again as where I did not use it.

Mr. Gould. I can give an explanation of that. The general rule is, that all crops belonging to the family of the cruciferæ,—that is to say, having flowers like the radish or turnip—injure the land. It is an exception to the rule to see a good crop of corn after cabbages, radishes, or turnips.

Mr. White. That brings to my mind another thing. I have raised turnips for some thirty years. I generally follow with oats; I never followed with corn before. The oats are smaller and more liable to rust.

Mr. Gould. Always; I never knew an exception.

Mr. White. I want to know if lime and plaster are no

correctives on that point. That was one reason why I brought the matter before this meeting. The grasses I have generally got rather heavier after turnips, after the second year.

PROF. JOHNSON. There seems to be a question here in regard to the action of plaster. All these plants of the radish and turnip family contain a volatile oil. You know that the turnip plant itself has an odor which is due to the presence of the volatile oil. In the case of the horse radish and similar classes of plants, this has been separated, and found to contain twice the quantity of sulphur found in other plants, and all these plants contain rather more sulphur, perhaps, than other classes of plants; and a part of the effect of superphosphate of lime, which is almost a specific fertilizer for turnips, although the phosphoric acid has doubtless something to do with it, comes from the fact that superphosphate of lime always contains half or more than half its weight of sulphate of lime. This class of plants contain a great deal of lime. You find in the ashes of all large-leaved plants, like turnips, beets, and tobacco, large quantities of lime. Still, the action of plaster is not necessarily explained by the effect of its ingredients. One of the most interesting points in the action of fertilizers is their indirect action, and in the case of plaster, this thing has been studied up, not enough, it is true, to afford a full explanation of the whole matter, but so as to give us some very useful indications, and show us that we cannot trace the action of fertilizers to the immediate effect of the elements which they contain. Plaster, for instance, may produce a very useful effect upon the soil where it does not supply the plant with sulphuric acid and lime, which are its ingredients. The simple fact is, that the elements of a fertilizer do not explain, necessarily, the reason of its action. As an illustration of this, take common salt. You may find hundreds of instances in which common salt has produced remarkable effects upon crops, while, with the exception of plants of marine origin, like asparagus, if you go through the analyses that chemists have made, you will find that plants contain very little soda and very little chlorine, which are the elements of salt. Experiments with almost all kinds of plants show

that both of these elements can be left out almost entirely, without making any difference in the products. Yet common salt acts as a fertilizer, not by feeding the plant, but by its action upon the soil.

Some years ago, two chemists, one in Germany (Baron Liebig), and another in France, made some observations, independently, which throw light on this question. The French chemist procured samples of different soils, some of which were benefited by plaster, and others of which were not affected by plaster, and treated each of the samples with water, to see what the water would take out of them. He took also similar samples of each of the soils, and poured on them the same amount of water, in which he had dissolved all the plaster that it would take up. Pure water will dissolve one part plaster to about four hundred and fifty parts of water. Almost all hard water contains a little plaster in solution. He used pure water in one case and a solution of plaster and water in the other case, and kept the mixture in agitation for a number of days, and then drew off the liquid and made a careful analysis of it. He found that those soils which were not benefited by plaster gave to the pure water the same quantities of certain elements, principally potash and magnesia, which they gave to the water containing plaster; the plaster made no difference in the ability of the water to dissolve those substances; but on the soil which plaster benefited, those two materials, potash and magnesia, were taken up by the plaster water in much greater quantity than by the pure water.

It is this solvent effect of plaster upon the soil which must be taken into account in considering its action, and the action of common salt upon the soil. That is the explanation of the action of salt upon our ordinary farm crops. All these materials which enter into the growth of plants have, in addition to their direct action as feeders of plants, this indirect action upon the soil, and therefore it is impossible to say, in any given instance, in what way a fertilizer acts, and it is impossible to say what will be its action without making a trial. All we can do is, to use these general facts, as we gather them, in

our farm practice. I will imagine, for instance, that my crop needs more potash. It is not necessary that I bring that potash from outside and put it on the land; perhaps it will be sufficient if I put something into the soil which will set the potash already there into activity. These fertilizers are not merely plant feeders, but they act as a means of unlocking the fixed capital in the soil and setting it afloat. It may be, in the case to which reference has been made, that the plaster which was applied previously to the corn crop, had had the effect to supply something which could not be supplied so well on the other part of the land; it may have been the sulphuric acid, it may have been the lime, which plaster contains, or it may have been this indirect action upon the soil itself.

There is one other mode in which plaster and other similar fertilizers may operate, which is a very interesting one. The first hint we got of it was furnished by Mr. Lawes, the English gentleman to whose experiments I have referred so often. Many years ago he conducted some experiments for the purpose of determining how much water entered into and escaped from the foliage of his plants. He prepared a number of boxes, a foot or two deep, in which he placed soil of different kinds, and sowed seeds of different kinds, as they would be planted for agricultural purposes. He put covers upon the boxes, with holes through them just large enough to admit the stem of the plant, so that the foliage was exposed to the air, and there was no other chance for evaporation of water except through the foliage. He also had a hole through which he could pour water, and he had a large balance constructed, so that he could weigh the boxes every day during the months of the growth of the plants. In connection with this experiment he made some observations which enabled him to notice the effect of various substances applied as fertilizers, and his observations showed distinctly that in the presence of certain substances the amount of water which went through the foliage was considerably less than in other cases with the same kind of plants. Mr. Lawes, in stating his results, simply referred to that point, but paid no particular attention to it, and the matter rested there for some ten years, when a German

investigator made a series of similar experiments, and he found that when he incorporated with the soil a small amount of plaster, common salt, sulphate of soda, or nitrate of soda, the quantity of water evaporated by the plant was reduced, in some cases, more than fifty per cent. If he added a free alkali, like potash, I think the quantity was very strikingly diminished. I do not know the explanation of it, but every one who has studied the question of the action of plaster has acquired the conviction that plaster attracts moisture. There must be some mistake about that. Plaster does not absorb moisture as some other substances do, yet its effect is, when incorporated with the soil, to hinder the evaporation of water by the plant, and that amounts to the same thing. It enables the plant to economize the water in the soil, and the water of rains and dews, to a greater extent than when the soil is destitute of the substance.

Dr. Riggs.—I would like to lay before the meeting some little difficulties that I have encountered in under-draining, to see if any one can account for them. I had a field about forty rods long and twenty wide, which produced bulrushes and bull-frogs principally, and was such an eye-sore to me that I determined to drain it. I laid six under-drains, forty rods long and ten paces apart, which divided the field into even portions. I believe in deep drainage rather than shallow, and these drains were at least three feet deep. These six drains all poured their water into a main drain, that ran nearly through a swale which I had previously under-drained. I put in two-inch tile, and to be very nice about it, and be sure that no silt or fine sand could wash into these drains, I had turf turned upside down, and put over the joints, and stamped upon, and a little stone placed each side of the joints to keep the tile, when jumped upon, from pressing one side or the other. About three years after this was done the first I knew, I went down to the field one day, and saw that there were streams of water running in several places. I dug down to the tile, and found the trouble; and here it is. [Exhibiting a fibrous mass, like jute.] I do not know what it is. I did not want to be defeated in that way, so I made up my mind to take up the

tile, clean them out, and put them back. I did so, but in about a year and a half up came the water again. I began to lose my faith in under-draining, and my neighbors began to laugh. Some of them thought this tiling was a queer thing. "Well," said I, "the only difference is, you put your pipe in your mouths, and I put my pipes in the ground." I dug them up a second time, and put in three-inch tile. and every sixty feet I put in a well; in other words, I sunk some of this large cement pipe which is made for sewers, two feet long and a foot in diameter in the clear, hacking out on each side of the pipe with a hammer, a place for the tile to rest in. My object was to have these roots, as they came down the tile, drop into these wells and sink to the bottom, while the clear water would run off. Since I have done that I have had no trouble. In case they do fill up I can dig down to these wells, run a pole in thirty feet and push out this stuff; but I have almost made a vow that I will never drain the field again. I will turn it over to the bull-frogs.

I cut a fine piece of rye upon the upper portion of the lot last year. I have got the east side seeded down to grass, where I had a heavy crop of oats that I cut to cure and put into the barn for feeding out this winter. On the south part of the lot, on the west end, I raised 700 bushels of turnips, and below that, where it was not under-drained, I raised potatoes, putting one eye in a hill, and had a good crop.

My theory is, that this is a blind grass, the same as the blind fish in the Mammoth Cave. Where there is no light they do not need any eyes, and I do not believe this plant has any mode of growing from a root. It is fed, in my opinion, by spring water and the air that circulates in the drain above the top of the water. There seems to be two kinds of it. I brought these samples along to see if any of our professors can tell where it came from.

Mr. Gould.—From a cursory examination through a magnifying glass there appear to me to be three kinds of roots in this mass. One I should suppose to be a root of the ordinary quack grass; another seems to me to belong to the genus *Phalaris Americana;* and the third seems to me to be a corn

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root. I will not give a decided opinion in regard to either. My impression is, from the circumstances of the case, inasmuch as the doctor has told us that his land was originally wet, and there was a channel of water on the surface, that the aquatic grasses, or, to speak more properly, the sedges belonging to the family of *Cyperaceæ*, and the rushes, belonging to the family of *Juncaceæ*, must have flourished there. The *Phalaris* is an eminently aquatic grass; it is the one that most frequently disturbs the equable flowing of our surface streams, and in some cases it has been known to choke up streams so completely that the whole region around was converted into a swamp.

With regard to all these plants I have mentioned, they are very reluctant to be dispossessed of the hold they once get upon the soil. If they once get rooted they will resort to the most astonishing expedients to prevent their own extirpation. I have repeatedly seen the roots of quack grass and the roots of this *Phalaris* run nearly twenty rods in search of water; and in dry seasons I have seen the roots of corn growing in the direction of a current of water to a length that perfectly surprised me. If there was any dry season when the doctor planted corn in that field it would strengthen my opinion that some of these are corn roots.

Dr. Riggs.—With all my previous under-draining I have had no trouble. By the by, I will say that I collar my tile with strips of tin about the size of my three fingers. I use for that purpose the old roofing of buildings, which I find lying about the country. I think these strips operate better than a loose collar; they keep the tiles from getting by each other, and they keep out the silt; but whether they will keep out these roots or not I do not know. I have not much faith in them in that regard.

Prof. Johnson. I should think that possibly the expedient to which plumbers resort in clearing out the water pipes about dwellings might be applied to drains, if laid on a uniform grade, as in this instance. Provided there was a simple arrangement at the upper end to fix a force pump, I should think these things might be worked out in this way. I know

that water pipes that were so clogged up that there seemed to be no way of getting water through them except by taking them up and clearing them out, have been cleared out in five minutes in this way. You might suppose that this drain pipe would be burst by the pressure, but the ground is packed around them, and they are pretty well supported on each side. I think the experiment is worth trying. It would be much cheaper than digging them up.

MR. GOLD. I have heard of those wooden pipes that were used for conveying water becoming partially obstructed with the roots of grass and such things, and they were cleared out by putting in eels at the spring. If you put in eels that are so large they cannot turn round, they have but one way to go. This is not mere theory; the thing has been done.

MR. WHITE, of Putnam. I would ask if any one here has tried to lay an under-drain, using nothing but stone; and what the effect was, and the comparative expense?

MR. DAY. I plead guilty to that a little. Everybody who knows anything about my farm, knows that I have plenty of stone, at least. Some ten or twelve years ago, I commenced to lay under-drains with stone. I had ditches dug three feet and a half in depth, and about twenty-two inches wide at the bottom, and walled them up. They operated exceedingly well for a time; but there is one difficulty I have found in stone drains which I do not anticipate in tile drains. Occasionally, there will be what we call a sinking or dropping of the ground; but still, my drains continue to operate well.

I can answer the gentleman's question in regard to the comparative cost of stone and tile drains, in part, at any rate. The ditch for a stone drain needs to be quite wide in order to get in the side stone and the covering stone. A tile drain may be dug just wide enough at the top for a man to stand in, and at the bottom, the width of the spade, so that the expense of digging a stone drain over a tile drain is nearly enough to cover the cost of a tile drain.

I should state here, that my drains have operated with wonderful success. Lands which, before I commenced to drain them, yielded about a ton to the acre, have been in-

creased three hundred per cent. No operations on my farm have paid me anything like the per cent. on the investment that under-draining has done. If I drain any more land, I shall certainly use tile, as a matter of economy, and as a matter of certainty, too. I have some tile drains, and I have never found any sinking in them.

MR. WHITE. I have laid stone drains, and found that they operated well, and were not very expensive. I suppose, in the way of digging, you might save a little by using tile. I have been somewhat troubled by mice getting into my drains, but I have never had them fill up, or fail to drain perfectly. I have received as much benefit from draining as Mr. Day has said that he has. Where I cut 1500 lbs. of a poor quality of hay, I now take off two and a half or three tons of a very good quality, and I manure but very little.

MR. DAY. There are always difficulties connected with stone drains. They will last, sometimes, very well for a long time, but sooner or later, they give out. I think it will generally be found that the tile drain, on the whole, is the cheapest, particularly when the joints are covered with a collar. But there are some cases where it is desirable, in order to get rid of stones, to dig a drain and bury them in that way.

MR. GOULD. The last gentleman has hit the difficulty. Sometimes, as he says, a stone drain will work well for ten or twelve years, and then, nobody knows how or why, the rats and mice will begin to work in it, and in a short time it is destroyed. That is almost universally the case, where stone drains are laid in the usual way. But there are stone drains that I have never known, under any circumstances, to be stopped up. In Tompkins and Chenango counties, N. Y., where there are a great many flat stones, drains are laid by placing these stones edgewise, and breaking joints. I believe that kind of a stone drain is absolutely indestructible; it will wear to the end of time. It is impossible for a mole or a rat to penetrate through. They work exceedingly well, and have generally proved very satisfactory.

While I am up, I wish to say that I hope the ingenious Yankee mechanics of Connecticut will turn their attention to

the making of machines which will dig ditches far more cheaply than they can be dug now. I have seen a great many ditch-digging machines in the course of my life, many of which worked exceedingly well. With one pair of horses, the machine would work out the ground very rapidly indeed. But the difficulty with them all has been, that they left an uneven bottom. The first condition of a good ditch is, that the bottom shall be left undisturbed, and be perfectly smooth, and these machines have failed because they left the bottom irregular. Three years ago, I experimented with a machine made by a man in Ohio, which was built upon entirely different principles from any which I had ever seen. In my hands, it was a most perfect success. The only reason I do not commend it to you positively is, that I have never heard of the machine since.

Dr. Riggs. I use a machine which I got up myself. With a yoke of oxen and two men, I can raise all the earth that any thirty men can throw out after me; but I have not got to that point, that my machine will throw out the dirt.

Mr. Day. I take out the depth that I can plow, perhaps six or eight inches, and then drop in a sub-soil plow, using a long yoke, so that my cattle can walk each side of the ditch, and by lengthening the chain, I can drop down eighteen inches further,—that is as low as I can go,—and pass up and down the ditch, so as to loosen the earth. I can make as perfect a ditch in that way as the Doctor does with his machine. I have to make quite a wide ditch.

Mr. Gold. I have practiced underdraining for twenty years or more, mostly using stone drains, and largely for the purpose of disposing of the stone. I have been moderately successful; yet perhaps it may be as profitable to refer to my partial failures as to my successes. My stone drains have failed, in part, from my anxiety to use up stone too freely; I have used too large stones, and filled the drains too full with stones. I have more recently, and I think with advantage, used tile. Although I had to obtain the tile from Albany, at a large expense for freight, yet I saved so much in the expense of digging in the exceedingly hard and tenacious hard-

pan which we have underlying all our moist lands and coming within a foot or so of the surface, that the digging is very expensive, and I have thought it was perhaps cheaper to use tile. I have no doubt of their greater permanence, for I have suffered from animals getting into my drains, and making holes, by which the surface water got in, and the earth fell in. But notwithstanding all these disadvantages and partial failures, my experience in underdraining I must pronounce as, on the whole, very successful.

I have in my mind a single field, of some four or five acres, which was rolling in its character, lying almost upon the brow of a hill, that was so springy that it produced absolutely nothing; it was not worth mowing. It lay right to the sun, on a gentle inclination, but the springs below swelled up so as to keep the cattle tracks full of water all through the summer and late in the season, water plantain and a few rushes being the only vegetation upon it. I put in stone drains there, and the field now averages two tons to the acre, one year with another, cutting it with the mowing machine, spreading it with the tedder, and raking it with the horse rake, and in the afternoon, it is fit to draw into the barn.

QUESTION.—Have you not applied more manure since you drained than before?

MR. GOLD.—Before the drains were put in manure never seemed to do any good, and it was considered useless to try it. When I took it up and plowed it in connection with underdraining, I put on one good coating of barn-yard manure, twenty loads to the acre; since then we have treated it as we have our other mowing lands. We calculate to top-dress with about what we take off; that is, once in three, four, or five years, give them a top-dressing. The draining was done some ten or fifteen years ago, and the turf formed upon the land is just as good, or better, than it was when the operation was completed. I have perfect confidence in the success of underdraining as a means of renovating our wet and cold lands here in Connecticut.

DR. RIGGS.—I might state that my successes in regard to crops have been abundant, and ample to satisfy my wishes; but this continuous trouble is what I want to get rid of.

MR. DAY.—A great many people complain about their cattle lying upon certain portions of the field, particularly around the barn, and leaving their droppings, making those portions of the field very rich, while other parts are comparatively barren. We have an old gentleman here who has had a long experience in farming, and who is one of the most successful farmers in the state of Connecticut. He is rich in experience, and although he is old, he has a great deal of vigor left. He can tell you how to make cattle lie in any part of a lot, and can give you an experience that is richer, perhaps, than that of any farmer in the state of Connecticut. I mean Colonel Mead, of Greenwich.

COLONEL MEAD.—Mr. Chairman, I have often been told that I am a great deal better in action than I am in talking. I am well aware that my thoughts are apt to flow a little too confusedly to be well understood.

I commenced, at the age of seventeen years, to manage a farm. The first consideration with me was to make manure, and I started with the idea of never letting an animal lie down in the stable or in the field without a good bed. I cut my swamp lands over, and stacked up the bulrushes, brakes, and every such thing, for bedding. I commenced draining at the same time. The first piece that I drained cost me about $125, and my first crop paid me some $180. I have found, in draining, that the first crop paid for the work. I have land to-day that was drained twenty-five years ago, that yields as much grass as it did when it was first drained, without any manure being put upon it. Now, all I have to say is, give your cattle bedding.. Save all the juices; they are worth full as much as the solids.

You must not be afraid to carry a load of manure, in winter time, half a mile. Your team can do it just as well as not; it does them no injury. In the spring of the year it is an injury, and costs, perhaps, too much; but it can be done in winter time, and if you dump it, a cart-full in a place, it will receive no damage.

My uniform practice is to spread the manure as soon as the frost is out of the ground, and let the rains wash the soluble

parts into the earth, and then turn the manure under in plowing time. I think there is a decided advantage in taking that course.

As to making the cattle lie in the pastures where you want the manure, this is the way. Cut down your shade trees about the watering places and the lower parts of the field, and encourage them to grow on the higher parts. Cut the coarse grass and weeds in the swales, and stack upon the dry knolls. The cattle will gather about it, and if scattered with a fork it will become a favorite place for the cattle to lie, and the manure will be dropped just where it is wanted.

I suppose I have thirty acres of drained land to-day, that is paying from 25 to 40 per cent. over and above the value of the land and the ditching at the time it was drained. That is a great deal to say, but I have a very good grass soil; probably it can not be beaten. I would say to every gentleman here—drain—*drain*—DRAIN—if it is but half an acre a year; the probability is it will add a hundred dollars to your capital; and if you will enter into this system, I have no doubt this Board will continue; it will grow stronger, and the day will come when the people of Connecticut will think they can not get along without it. I think the more the farmers of the state inquire into the purposes of this organization, and what it is doing, the more they will be convinced of its usefulness. No man who has attended these meetings can go away without having acquired a vast fund of information. For instance, it has been stated here that oats do not succeed well after turnips, and that information is of value to every farmer.

MR. WHITE.—I think the gentleman is right in what he has said about not being afraid to draw manure to distant parts of the farm. Where I live the idea was not to go too far from the barn; it was thought that it cost too much; the consequence was they did not have much good soil, and the crops were small. It has been my practice, ever since I commenced farming, to take lands that had been run out, it made no difference where they were, and I keep up a uniform system all through my farming. I have been remonstrated with from the beginning, and told, "You carry your compost too far; it

costs too much, and it is not profitable." Well, whether it is profitable or not, I can say this much: I began with nothing, and I am sure I hold my own. You know that last year was an unfavorable one for farmers to make money. I hired two men, giving one $25 a month and the other $26, and I hired another man, who left in the month of July, for about the same price. It has been claimed that we can not raise grain to a profit here in New England. I raised last year nearly 800 bushels of grain; I had two acres of very good potatoes; I had three-quarters of an acre of turnips; I mowed over something like seventy-five acres of grass. Now does this pay? Could I have bought, at present prices, as much grain for the amount I expended? I could not. I can raise my corn cheaper than I can buy it, and I believe that if we keep our farms up, we can carry on our business with profit.

COLONEL MEAD.—If there is any young man here who will take an acre of natural grass land and work upon that until it is like a garden, as it should be, and then take another piece, and so on, when he is forty years old, if he has not increased the value of that farm one-half more than that of the farm of any young man who goes on in the old way, afraid to lay out a penny, then I am very much mistaken. The great mistake of farmers is in not seeing that every improvement adds so much to their capital. The farm that I am on produces six times as much as it did in 1830, taking the average right through.

DR. RIGGS.—My advice to a young man is, when he buys a farm, to get as much arable land as possible, and land requiring the least drainage. If he has a piece of swale land, or muck, or swamp, when he gets to it let him improve that, and make it good meadow land. This buying two or three hundred acres, with hardly a place where a man can cut any grass or get a crop, because the water is so abundant upon it, is rather discouraging business for a young man, unless he has a large capital. That is my advice. If I were going to buy over again I should try to get a good deal of what we call sandy loam. It is more easily restored, and produces quite as good crops as these lands which need so much under-draining,

so much "cellar work," as I call it. If a man is so situated that he can not leave the paternal acres, if he has too much water on his farm, I would have him go to work and under-drain, and redeem it, so that it will pay him to cultivate it. But it is expensive to under-drain, and if a man has a whole farm that needs draining, he must add to it the price of one or two more like it to make it available.

COLONEL MEAD.—According to my observation about one-quarter of our farms, on the average, need under-draining.

MR. GOULD.—I have said a good deal since I have been here, much more than I ought, and yet I do not wish to take leave of this convention without saying a few words more.

I feel the deepest interest in the occupations of agriculture. I feel the sincerest and deepest sympathy with my friends who are engaged in agricultural pursuits. I wish to see the time come when farmers shall cease to grovel in the earth, and rise to a higher stand-point, where they can breathe an ampler ether, a diviner air. I want to see the time when, if a man shall come to our country from a foreign land to see and examine whatever we have that is noblest, purest, most intellectual, and best in every respect, he will not go every where other than among the farmers of the country to see it. The time has passed by when a farmer can afford to be ignorant, can afford to be a fool. If it is necessary for any one man in any department of life, to have a thorough knowledge of all the laws of creation, that man is the farmer. The lawyer may exist perfectly well without a knowledge of insect life, but it must increase greatly the revenue of the farmer to become a good entomologist. He is the man of all men who can put money in his pocket by the acquisition of entomological science. Professor Johnson may investigate the science of chemistry in his laboratory, but he can make no more money by discoveries in his laboratory than he could in any other pursuit; but to the farmer it is indispensably necessary. Professor Johnson may turn to some other employment, and have as good pecuniary success in that as he does in that which he is now following, but it is the breath of life to the farmer. Without a knowledge of chemistry it is utterly impossible for

him to go through his processes with any degree of intelligence. Circumstances are occurring every day under his hand, which are absolutely inexplicable without the aid of the lights which the science of chemistry sheds upon his path. Geologists follow out the science of geology, simply to gratify their own intellectual promptings and desires; but to the farmer, it is a matter of life and death to know something of the structure of the earth, something of the nature of the rocks. It is impossible for him to understand the composition of soils without a knowledge of this science. And so I might go through the whole range of the sciences. It is utterly vain for us to look for a single one of them, the acquisition of which will not put money into the farmer's pocket. It is necessary for him, in order to obtain the maximum of success, to be a perfect encyclopedia, in himself, of all the arts and sciences. But, sir, how has it been heretofore? If there has been one man more than another profoundly ignorant of any and all the sciences upon which the prosperity of agriculture depends, it has been the farmer. It is time, sir, that this opprobrium upon the farmer's profession should cease. He should look higher; he should aim higher; he should desire constantly, every day, to make himself nobler, grander and better than he was the day before. It has been painful to me to hear farmers, men who are really getting their living from the soil, speak contemptuously, as I have heard them since I came here, of agricultural schools, and all the various means which have been provided for bringing together the lights of agricultural science, so that they might be concentrated and conveyed directly to the mind of the farmer. That men should be so utterly insensible to the value of these operations as some of you farmers here in Connecticut are, astonishes me, discourages me, and disheartens me! But, sir, I am thankful to say that I have seen a better and nobler spirit in most of your farmers. That feeling is confined to a few old fogies of the past, who still walk about blindly on the earth, diffusing their darkness all around them, having apparently no other object in life than simply to make darkness visible.

I hope that every year will add to the ambition of the farmers of Connecticut, that they will every year strive to occupy a higher station, and that they will every year acquire a better knowledge of the great principles of science.

These things I wished to say, and before I take my seat I wish to say one or two words more. I most heartily concur in the opinions which Col. Mead has expressed here, and if I can intensify them by anything I can say I desire to do so. I believe, Mr. President, that there is scarcely a man in the United States who has seen as many farmers and examined so many agricultural processes, over the whole length and breadth of the Union, as I have; and, sir, I wish to say, as the result of that experience, that I have never known a single well-directed effort toward draining that was unsuccessful. I have never seen a drain well put in that did not pay at least ten per cent. upon its cost, and I have seen them pay 150 per cent. on their cost, the very first year of their operation. Drainage lies at the very basis of all successful farming. Your manures have double the value when the land is drained that they had before. A wagon load of manure on drained land is worth two wagon loads on undrained land. In fact, there is no comparison whatever. However much you may increase the manure you put on your land, it is impossible, on undrained lands ever to raise crops which in amount or in quality shall compare with those on drained lands. If you are really to follow out the line of progress which I have indicated, this is the way you must begin. This lies at the foundation.

I have said that I have never seen an unsuccessful effort when land was well drained. I have seen a great many ditches and drains put in where there was not a particle of benefit from it, and why? Because ordinary and common intelligence was not applied to the work. It is improperly laid drains which have produced in the minds of farmers that feeling which finds vent in the opprobrium they cast upon the efforts of their neighbors in that direction. If you make a drain zig-zag, up hill and down, you cannot expect it to be of any advantage whatever. The bottom of a

drain should always be continuous. The height of the spring should be estimated, and it should be carried down with one uniform slope, never for one instant rising above the slope. As far as possible, a drain should be straight, or, if that is impossible, the curves should be as large as possible, never sharp. It is horizontal and vertical curves which prevent the efficiency of drains.

I have seen with my own eyes cases where the temperature of the soil has been raised twelve degrees by putting in a drain. That is equivalent to the difference in latitude which exists between Connecticut and South Carolina. Who can overestimate the advantage of such an increase in temperature? Again, when the ground is saturated with water, it is utterly impossible for those chemical transformations which are indispensable to the liberation of the soluble materials of the soil to go on. When the oxygen of the air is prevented from access to it, by saturation with water, it is impossible for the carbonic acid to be generated, or the humic acid, which is necessary for the solution of the mineral matters. The first thing, therefore, to be done, is to drain this off.

Then, again, in many cases, there is as much advantage from the air which circulates through the drain, as there is from the water that goes off. In the first place, the air which circulates through an underdrain, penetrates upwards as well as downwards, and the ground is aerated in a remarkable manner.

Again, lands which are underdrained can withstand drouths a great deal better than those which are not drained, because, the drains being cooler than the upper portion, the air which is circulating through it, deposits dew on the interior of the tiles, which is absorbed by the ground, and in this way that extreme aridity which sometimes takes place is prevented altogether by this action of the underdrain upon the air which circulates through it.

There is another point to which I wish to refer, and that is the necessity of varying the food of cattle. Cattle are never satisfied, even with the very best; a change once in a while to an inferior food will be found to be highly satisfactory

to them. If you lay in one side of the manger a lot of the best hay, and in the other side a lot of the poorest, you will very often see the animal, of its own accord, turn from this sweet, fresh hay, to taste of another kind, which is not so pure, which enables him to assimilate the food he takes of a better kind in a way of which we have very little idea. This is true, not only of our cattle and horses, but of poultry. Do not feed your poultry with any one thing, but give them a choice ; throw them something different from what you have been accustomed to give them, and if you find that they eat it with avidity, contrive to feed it to them. It is equally true with regard to ourselves. There are times when we turn from the richest and most delicious viands, to the old-fashioned rye-and-indian bread and find it a more delicious morsel than the finest bread that was ever made in any of our restaurants. The stomach is a curious organ, and we must study more thoroughly its physiological action if we would feed our animals in the best and most successful manner.

I desired to add my testimony to what has been said on the points to which I have referred, and I hope that the farmers here assembled will, without accepting the dictum of anybody, think these matters over, try experiments for themselves, and if they find they profit by it, let them go on in the way that has been indicated for us.

On motion of Mr. Robinson, a vote of thanks was passed to Mr. Gould for his presence, and for the interest which he had added to the meeting by his lectures and addresses, and the Board then adjourned *sine die.*

REPORTS ON CROPS.

In September, 1871, the Secretary issued a circular of inquiries upon the following crops, embracing their culture and produce: Wheat, Rye, Oats, Barley, Buckwheat, Corn, Potatoes, Onions, Tobacco, Broom Corn, Beans, and Root Crops.

These circulars were sent to every town in the State. The importance of introducing new and better varieties, and of devising better modes of culture, should have secured more full replies. Every one could tell something worth knowing to his brother farmers about his crops, success or failure, and should be free to communicate.

From their miscellaneous character it has been found impossible to classify them, but they contain many valuable facts and suggestions, and will repay careful study.

The Potato.

ALEXANDER HYDE, LEE, MASS.

The potato has grown within the last 200 years from nothing to one of the leading crops of the civilized world. With the exception of corn,—and some would also except tobacco—it is the greatest contribution that the discovery of the western hemisphere has made to the vegetable productions of the earth. The potato is the most farinaceous of all the roots, and makes the best substitute for bread. It holds the same rank among esculent vegetables that water does among drink; it is universally agreeable. Some like turnips, a few like cabbages, occasionally one can be found that will eat an onion, but all like potatoes. Potato accompanies meat almost as much as the shadow follows the substance. The almost universal acceptance of the potato, as an article of diet, is due to its mild, agreeable flavor. We can occasionally drink tea or coffee, or milk, not to say lager or anything stronger, but for a steady drink commend us to cold water. So for a steady vegetable commend us to the potato.

One of the great recommendations of the potato is that it can be cooked in such a variety of modes, the culinary art

thus making as it were many vegetables out of one. When we eat a baked potato, just pressed enough as it comes from the oven so as to start every cell, let off the moisture, and exhibit the dry, sparkling granules of starch, we are ready to say this is the simplest and best mode in which the potato can be cooked, and the conclusion is not far from the truth. We do not remember ever eating a square meal of turkey or roast beef with greater satisfaction than that which we have enjoyed over a few potatoes roasted in the ashes, with no seasoning but salt and the relish which a hard day's work furnishes to all food. When Rose potatoes have been pared and placed in cold water over night and boiled in the morning, and when just ready to crumble the water is poured off and the potatoes left in the pot to exhale their moisture and become white and sparkling as the new fallen snow, as we cut them open and eat them with the addition of a little butter, salt and pepper, we say, "This is a breakfast fit for a king." Again, when they are sliced raw and dropped into boiling fat till they are brown and crisp, we know nothing in the vegetable line more acceptable, except to dyspeptic stomachs. Most persons like potatoes mashed, well seasoned with butter and salt, and then placed in the oven till they are nicely browned. All we can say to such is, that if they prefer them fixed in this way, it is just the way in which they should be fixed.

If a potato is not eaten the day it is cooked it is not lost. Indeed many prefer it warmed over. Cut up into small bits as large as a pea and warmed on the frying pan with a little butter till they are browned, they are, if possible, a little better than when baked or roasted in the ashes. If any one makes objection to them when cut up in quarter-inch pieces and warmed in the same way, he must have either a fastidious taste or an o'er delicate stomach. Cut up with fish and cooked in that well known mode, called fish balls, they make one of the most acceptable of breakfasts. Hashed with the remains of yesterday's roast or boiled beef, they are most too good for the every-day living of common folks.

How our fathers lived without this esculent is a mystery to us. They were contented without potatoes because in

blissful ignorance of their virtues. The soldiers in our late war tell us that there was nothing of which they felt the deprivation more than of potatoes, and we have been amused at the recital of some of the contrivances to which the soldiers resorted to make bread, rice and crackers a substitute for this root. One of them told us of making hash of meat and crackers. Said he, "It made a pleasing variety, but I would have given more for one potato than a pound of crackers."

There can be no question but that the introduction of potatoes as a common article of diet, has produced a civilizing influence on mankind. We cannot go all lengths with those physiologists who maintain that a man's character can be determined by the food that he eats, but that the food exerts some influence on the character, there is abundant proof. Our Saxon fathers, who lived mainly on meat, esteeming a boar's head the greatest of delicacies, had a little too much of the wild boar in their composition to live in peace with all men. If they finished one of their great convivial feasts, in which game was the chief viand and ale the chief drink, without a general melee, it was the exception, not the general rule. We can see the effects of an exclusive meat diet, even on the inferior animals. A dog fed on raw meat is savage, ready to quarrel with any dog he meets. Fed on hasty-pudding the same dog is peaceable. There is a peculiar stimulating principle in meat, which the chemists call kearin, similar to theine of tea, or narcotine of opium, all healthy enough in its action on the human system if not taken in excess. The stimulus which meat gives us is probably just what we require for muscular or mental effort, but it needs to be diluted with some vegetables, or it drives our physical machinery so fast that we wear out too soon, and potatoes, next to bread, are the most acceptable accompaniment and diluent of meat.

The history of the potato is at once interesting and instructive. We have already intimated that it is a native of America. Potatoes were first carried to Spain from South America, their native home, about the middle of the sixteenth century, under the name of papas. Sir Walter Raleigh first

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introduced them into Ireland in 1586, and planted them on his estate near Cork. The Irish took to them much more kindly than the English, John Bull loving his old dinner of roast beef without accompaniment, except bread and ale. In the middle of the seventeenth century potatoes were little known in England, being raised in botanical gardens as a curiosity rather than an article of diet or commerce. In 1663 the Royal Society took some measures for encouraging their growth as a dernier resort in case of famine, and as food for swine and cattle. The potato however was a plant of slow growth in England. Evelyn, writing in 1699, says, "Plant potatoes in your moist ground. Take them up in November for winter spending; there will enough remain for stocking though ever so exactly gathered." In the Complete Gardener, published in 1719, the potato is not even mentioned. It was not till the commencement of the present century that they may be said to have obtained a firm foothold among English and Scotch farmers, though the market gardeners around London quite generally cultivated them at the close of the eighteenth century. We measure the life of an animal pretty correctly by the length of time required to reach its maturity. If the popularity of the potato can be gauged on this principle, it has a glorious future before it.

The value of potatoes as a farm crop gradually appreciated in the United States, till the blight of 1845 and succeeding years almost paralyzed the efforts of farmers for their cultivation. Many thought this vegetable was then struck with consumption and would surely perish from off the face of the earth. Not so thought Rev. Chauncy E. Goodrich, of Utica. He carefully studied the nature of the potato disease, and came to the conclusion that it was the result of bad cultivation. The constitution of the potato, he concluded, had become weakened from long propagation from tubers, without renewal from seeds, and this without proper selection of the tubers to be planted or the quality or preparation of the ground in which they were to be grown. He accordingly sent to South America in 1848 for some fresh tubers with which to start their propagation *de novo*. For fifteen years he continued his

experiments, raising new varieties from the seed of his imported tubers, starting in all some fifteen thousand kinds and selecting from this large number only ten or a dozen which, after years of trial, he concluded possessed a vigorous constitution and such qualities as made them a desirable table potato. One of the earliest varieties originating with Mr. Goodrich was the Garnet Chili, the parent of our present famous Early Rose and Peerless varieties, the Garnet still remaining a prolific, healthy and acceptable variety. To Mr. Goodrich also we are indebted for the Gleason, Harrison, Early Goodrich, and other valuable varieties.

Since Mr. Goodrich's day the value of the potato crop has appreciated steadily and probably never stood as high as it does now. He may not have been altogether correct in his theory of the disease of this root. We are inclined to think there was some subtle climatic influence which aided in the production of the disease, if not its first cause, as some of the varieties which were considered at that time unhealthy and were given up by most cultivators, have since renewed their age and are now productive. However this may be, we are greatly indebted to Mr. Goodrich for his persevering efforts to introduce new varieties, and his careful study of the habits of the potato. The results of his observations he communicated to the Secretary of the New York State Agricultural Society, and they form a most interesting chapter in the volume of "The Transactions," of that Society for 1863. What makes Mr. Goodrich's labors in this direction the more remarkable is the fact that from some idiosyncrasy he never ate potatoes himself.

Mr. Goodrich died in the midst of his experiments, but his mantle seems to have fallen on Mr. Albert Bresee of Hubbardton, Vt. From the Garnet Chili, as parent stock, Mr. Bresee has produced some seedlings which bid fair to have a national reputation. The Early Rose has such a reputation now. The Prolific is also a No. 1 potato. It is of fine shape, hardy character, and excellent quality, and though not as productive as its name might imply, is above the average in this respect, if we may judge from two years cultivation. No one

should condemn the Prolific from the first trials of it in autumn, for it is one of those potatoes that becomes more farinaceous as the winter advances. In common with many others we were sadly disappointed in our first crop, as the quality was by no means equal to the samples we had tried the previous spring, but as the winter wore away, the Prolifics improved, and we finally decided that if they had been called Supreme instead of Prolific, the name would have been more consonant with their nature, for we know of no potato that is superior to them in the last of the season. But the potato that is both prolific and excellent is Mr. Breese's Peerless. It is the coming potato for a general crop if it is safe to prophecy this much of any man or any potato. The Peerless is pronounced on all hands excellent in quality, and as to its productiveness we know nothing equal to it. On good ground it yields four hundred, five hundred, and even six hundred bushels to the acre, all large, some of them too large. We have weighed those that brought down the steelyards at three pounds, and have heard of those that weighed four pounds, but notwithstanding this enormous size they are not coarse nor hollow hearted. We do not consider this great size a recommendation of the Peerless, but it is encouraging when there has been so much croaking about "small potatoes and few in a hill," that we can raise again large crops of large potatoes. It proves that if consumption had ever fastened upon this vegetable that the disease is pretty much cured. It is but justice however that we should say that we found last summer a few rotten Peerless potatoes, when the Rose, Prolifics, Garnets and Colebook Seedlings, growing in similar soil and with similar cultivation, were perfectly sound. The defect of too great size, if it may be called a defect, may be remedied by selecting year after year medium sized potatoes for seed. In the same manner the inclination which the Peerless manifests to grow irregularly, projecting a tumor here and another tumor on top of the first, may be cured in the process of time by planting only those potatoes that are smooth and of good form.

This leads us to say that farmers are not generally careful

enough in the selection of their seed. The common practice is to sort at the time of harvest the large from the small, reserving the former for the table and planting and feeding out the latter to stock. In the spring the potatoes are taken promiscuously from the bin for seed, without reference to their shape. If we should use the same care in selecting our seed potatoes that we do in selecting our seed corn, we should have less deformed and monstrous tubers, for the law holds good in roots as well as seeds, that like produces like. There is no question but that if we should select for planting, potatoes with wart-like excrescences upon them, and do this for a succession of years, these excrescences would finally become a fixed characteristic, and if on the other hand we plant only smooth well shaped potatoes year after year each succeeding crop will improve in form. We have as much faith in thorough-bred potatoes as in thorough-bred Durhams.

Formerly the doctrine was that if small potatoes were used for seed—using the word in its common not its scientific meaning—the crop would be just as good as though larger potatoes were planted. In favorable seasons the first year's crop might not show any great deterioration, but let this plan be pursued for a series of years and degeneracy will surely follow. We have tried this to our satisfaction. An onion may be made to grow in the shape of a cracker or of a globe, by selecting flat or round onions year after year for seed till the habit of growth has become fixed, or as we may say of animals thorough bred. The same principle holds good with potatoes. The product of oval-shaped seed inclines to be oval, round produces round, small potatoes are the parents of small potatoes. In short, like produces like. He that would raise a good crop must plant good seed.

The results of our recent census prove that the potato crop is worthy of all the care we can bestow upon it. None of the common crops—tobacco excepted, which perhaps can now be called common—raised in the northern states, show so great a return in money value per acre as potatoes. The prevalent opinion is that corn is king among crops and so it is taking the whole crop of the whole country, as the total value of the

corn crop for 1870 ran up to $601,839,030, cotton to $286,000,000, wheat to $245,865,045, oats to $107,136,710 and potatoes to $82,668,590. Leaving out cotton, which is not a northern product, it will be seen that potatoes rank fourth among our cultivated products. Perhaps it is due to the hay crop, very little of which is grown in the cotton districts, to say that the money value of this crop exceeds that of cotton by $52,969,680. But when we examine the returns per acre, potatoes are ahead of corn, wheat, oats and hay. If we may trust Gen. Walker's figures, the average acreable value of potatoes in Maine for 1870 was $82.50, while that of corn was $37.62. In Massachusetts corn yielded an average return of $32.34, potatoes $84.48. In Connecticut corn yielded $30.09 per acre, potatoes $72.27, or more than twice that of corn. The average number of bushels of corn per acre in Maine for 1870 was 33, of potatoes in the same state 125. In Vermont, which is the banner state of the Union for its acreable product of corn, and, with the exception of California, the banner state also for potatoes, the acreable product of the former is 39.6 bushels, and of the latter, 140 bushels. Not to pursue these dry statistics further, the conclusion is manifest that if a farmer wishes to realize the most money from an acre of land with any of our common crops, he must raise potatoes.

The intrinsic as well as money value of potatoes is also great. The analysis of this root shows that it contains about as much dry solid matter as lean beef. The proportions of nutritive matter varies, as is well known, in the different varieties, but Johnston gives the following as the proximate analysis of the potato.

Water, - - - - - -	75.52	per cent.
Starch, - - - - -	15.72	"
Dextrine, - - - - -	.55	"
Sugar, - - - - - -	3.30	"
Albumen, - - - - -	1.41	"
Fat, - - - - - - -	.24	"
Fiber, - - - - - -	3.26	"
	100.00	

The peculiar characteristic of this root is the quantity of starch it contains. The quantity of dry solid matter depends not only on the variety but also on the age and maturity, the most mature often having 30 per cent. of solid matter. The quantity of starch is at its maximum in the autumn and early winter. As the winter advances the starch seems to be converted into sugar, and prepared for the support of the growing buds. The nitrogenous, or muscle forming matter, in potatoes, it will be noticed, is small. Hence potatoes should never form the exclusive diet of man or beast. The great value of this tuber is evidently to supply carbon, in the shape of starch, for the purpose of sustaining animal heat. At the same time, in consequence of the great yield per acre, much more nourishment can be produced from a given amount of land by potatoes than by any of our common crops. Though the nitrogenous matters in a pound of potatoes are small in comparison with those in a pound of wheat or corn, still an acre of potatoes will furnish one and a half times as much nitrogen as an acre of wheat and four times as much starch. Thus after the introduction of the potato into Ireland the land was capable of sustaining a much larger population, for one acre of this root could form the chief sustenance of a family, whereas it had previously required three or four acres of grain.

It is worth while to glance a moment at the analysis of the inorganic constituents of the potato, as this will show us what inorganic matters the crop will demand for its support. The ash of this root varies with the different varieties, but generally amounts to a little less than 4 per cent. of the weight of the tubers. Of this ash

Potash	forms	55.75	per cent.
Soda	"	1.86	"
Magnesia	"	5.28	"
Lime	"	2.07	"
Phosphoric Acid	"	12.57	"
Sulphuric "	"	13.64	"
Silica	"	4.23	"
Peroxide of Iron	"	.52	"
Chloride of Sodium	"	7.01	"

It will be seen from this analysis that potash is the leading constituent of the ash, forming more than one half of the whole. Hence wood ashes make one of the best of manures for the potato crop. Sulphuric acid is the next largest constituent, and this is most cheaply and conveniently applied in the form of sulphate of lime (common plaster). Phosphoric acid also abounds, which we find abundantly in bones, or in the manufactured phosphate of lime. Chloride of sodium (common salt) is also a large inorganic constituent, and this should always enter into the compost heap which fertilizes the potato patch. The refuse brine of the family and the grocery will generally furnish all the common salt required for raising a large crop of potatoes. We have been in the habit for years of sending round to the stores for refuse fish, pork and beef brine, which the merchants formerly emptied at their back doors, and from this addition to our compost heap have derived great advantage.

The soil for potatoes is a dry, sandy, or gravelly loam, containing an abundance of both organic and inorganic matter. Heavy clay loams are too compact for the potato, but such soils may be made light and porous by thorough drainage, and the incorporation of an abundance of muck, chip manure, or leaf mould from the forest. We have seen most excellent potatoes raised in a drained muck swamp by covering the muck with an inch or two of sand. The tubers turn out most plentifully and of the best quality from a soil abounding in vegetable matter. New land, just redeemed from the forest, gives large crops, and the tubers grown on such land are uniformly healthy, mealy, and of fine flavor. Even when the potato disease was at its height new land produced large, healthy tubers. Old land may be rejuvenated by a thick coating of muck, or when this is not convenient by plowing in a crop of clover or buckwheat. By a free use of muck we have raised large crops of potatoes on the same ground for a succession of years, but we do not recommend this practice. A rotation of crops is a law as distinctly written in nature as in the books. Other things being equal, a sod soil is much preferable to old plowed land for raising potatoes. The in-

version of the sod furnishes much vegetable matter and renders the land pervious to air and moisture. The aëration of the soil is of great consequence to nearly all crops, but is specially important to the potato. The air is a great storehouse of fertilizing material, and is ever ready to give up its treasures to the rains and dews, and even to carry them to the rootlets of plants, if the condition of the soil is such as to give it free access. Most farmers have an idea that all fertilizing material comes from the land. To disabuse their minds of this notion it is only necessary to state the simple fact, that when any vegetable is burned or decays, 96 per cent. on an average of its material composition vanishes into the air. From the air all the organic part came and to the air it returns. The ash, constituting a small but important fraction, came from the earth and to the earth it clings. All the nitrogen of plants, and most if not all the carbon comes from the air. It is therefore of the utmost importance that the soil be kept porous, ready to absorb these gases from the air and give them up to the growing plant.

So far as the soil itself is concerned it must contain potash, soda, lime, and all the inorganic constituents enumerated in the above analysis of the ash of potatoes. If these are present and the soil kept light, the remaining constituents, constituting the great fraction of their weight, will be absorbed from the air. We recommend muck and other carboniferous manures for potatoes, not so much from the fertilizing material contained in them, as from their absorbing power. Their action is doubtless two fold, chemical and mechanical. That there is fertilizing material in muck and leaf mould no one will deny. There is no organized matter but that in its decay will furnish material for new forms of life. Nature husbands her capital too carefully to allow one particle to be lost. Leaf mould is specially abundant in potash and other earthy matter, and hence one reason why potatoes always flourish in a soil just redeemed from the forest. Another reason doubtless is, that a soil abounding with carboniferous matter is always light. Air and moisture penetrate it readily and in their passage leave large deposits of enriching gases.

The question of the best varieties of potatoes we have alluded to already, and shall dwell upon it but for a moment. We desire however to say that too much praise can hardly be bestowed on the Early Rose. It is good from July 4th till the fourth comes again. It is hardy and productive. Some object to it as not having sufficient flavor, but such persons would probably object to pure spring water as not having flavor. It is this absence of any very decided taste that makes the Rose so acceptable to the multitude. Of the Garnet Chili we can only say that it has a most robust constitution, and is the worthy parent of worthy offspring, the succeeding generation excelling the preceding, as it always should. The Early Goodrich was good in its day, but that day has passed, the Rose as much surpassing the Goodrich as the Goodrich surpassed the Early June. It is perhaps early to judge of the King of the Earlies, but so far it does not seem to merit its name. As a general rule it is not worth while for farmers to raise too great a variety of potatoes. Amateurs can raise and exhibit their two or three hundred varieties, but we should prefer two or three to three hundred. It is doubtless best to raise more than one variety, for it is a singular fact that one kind succeeds one year and partially fails the next, and it is hazardous risking all our eggs in one basket. Men's tastes and judgments differ, and we desire no one to pin his faith implicitly on our sleeve, when we say that with our present experience we should not hesitate to plant the Rose, Garnet Chili, Prolific and Peerless as our chief varieties. This matter of varieties is one of no little importance. The profit of a crop hinges on the variety much as the profit on a herd of cattle depends upon the breed. If the Peerless continue to yield in the future as they have done in the past, the 114,775,000 bushels which Gen. Walker reports as the crop of the United States for 1870, may easily be increased 50 per cent. by planting the Peerless.

How to plant is another question of some importance. We formerly planted in hills three feet apart each way, and this is still the more common mode. It has the advantage of allowing the cultivator to run both sides of each hill. We

find, however, a greater return by planting in drills, dropping a third or a quarter of a medium sized potato about a foot apart in the drills. The covering can be done by a plow. If a composition of ashes, plaster and fine salt be sprinkled on the potatoes before being covered, in the proportion of five bushels of ashes, one of plaster, and half a bushel of salt, it will be found a very cheap and very effectual fertilizer, all the more effectual if a bushel of superphosphate of lime be added to the compound. The latter article is, however, so often adulterated that farmers are not always sure of obtaining what they bargain for. Between the drills we run the cultivator often to keep the ground well aërated. It is well to do this after each rain, for this packs down the soil and on clay land a thin crust forms on the surface which greatly impedes the entrance of air and moisture unless broken. One hoeing is generally sufficient, but just as the vines have obtained their maximum size and while they are still erect, we run Shaw's cultivator, minus the teeth, between the drills, the mould boards of which push the dirt to the sides of the potatoes, making a bed for the young tubers to rest in as soft as the feather beds on which our mothers used to sleep.

To cut or not to cut the seed is the question with many farmers. Planting, as we do, in drills, we always cut the seed, for we wish to plant medium sized potatoes, and one potato in a place would be overstocking. To those who plant in hills whole potatoes are not so objectionable. The eyes in this case have more starch in the parent tuber from which to draw nourishment till new rootlets are sent out. Cutting is certainly a rather rough surgical operation, and in a cold, wet spring cut seed is more apt to decay, as the skin of the whole potato, being of a corky nature, keeps out the wet. To guard against this tendency to decay in cut seed, we place it in a barrel as soon as cut, put on a quart or two of plaster, and give the barrel a good shaking. The plaster adheres to the wet surface, and besides forming a barrier against the access of moisture, furnishes some food for the young plants. It is often objected to planting whole potatoes that too many stalks grow in a hill. There is some weight in this objection,

but not so much as we might suppose. Experience proves that although all the eyes may start to grow, only the more vigorous live. Society in a potato hill is much like a society of men. The strong are sure to obtain the mastery over the weak.

The potato harvest is often accomplished in a bungling, careless manner. The tubers are cut and bruised as though they were not delicately organized things of life. We forget that every time we bruise a potato we break more or less cells and increase the tendency to decay. We have learned to harvest apples carefully. We have need to learn the same lesson in reference to potatoes. In harvesting we much prefer the shovel to the hoe or potato digger. It requires a little skill and a good deal of strength to run the shovel under a hill and raise the potatoes and dirt together, at the same time giving a little vibratory motion to the shovel so that the dirt will crumble and leave the potatoes in open sight. This can be done, and we have never seen potatoes harvested so expeditiously and with so little damage. Not only are the potatoes uninjured, but the land is greatly benefited, for it looks like a garden spaded over and ready to be sown.

When dug the potatoes should not be long exposed to the sun. The digging should be performed on a dry day, and as soon as the moisture on the surface has evaporated the tubers should be picked up, carefully placed in the cart, and, if not immediately hauled to the cellar, covered with a blanket or potato vines. It is not a bad plan to place them in piles in the field, cover them thoroughly with potato tops and a little dirt, and make one job of hauling on some pleasant day. In all cases do the sorting while harvesting, and by all means keep the different varieties by themselves. The mixing of all sorts of potatoes may be very democratic, but there is an aristocracy among potatoes which deserves recognition.

When potatoes are first placed in the cellar, there is an unpleasant effluvia arising from them whether they have any tendency to rot or not. This may be remedied by sprinkling a little air slacked lime on them. The lime will also prevent decay.

We have thus gone over briefly some of the principal points in the history, physiology, and cultivation of the potato. The subject deserves a more extended elucidation, but we have feared taxing your patience too much. If anything we have said commends itself to your good judgment, and will advance the cause of potato culture in New England, our labor has not been in vain.

S. N. BEERS, (Sandy Hook P. O.), NEWTOWN.

This town being more generally devoted to raising and fattening stock, and the production of milk, the growing of farm crops is but a minor resource of profit.

Wheat and barley are seldom raised, though but for the want of the harvester and thresher I think with a liberal allowance of manure they would succeed as well here as in many western localities. This has been my experience with wheat. Rye is grown to a very limited extent on our thinner soil. Strong soils produce a poor quality. Nearly the same may be said of buckwheat.

Onions, tobacco, broom corn, beans and roots are only occasionally grown, more as a matter of experiment than as a crop to be relied upon. Tobacco has occasionally paid the producer well, but its consumption is much to be deprecated. The root question is one which should demand the attention of the best stock farmers. They give stock kept on dry feed, a sleek and thrifty appearance, causing a good appetite and a degree of health scarcely attained otherwise, but with the large expense and inconvenience of storage and the high cost of labor to grow them; will it pay to produce largely? Another question is, shall we raise or buy our corn? Much less is raised here than 15 years ago, most of the milk producers now buying their entire supply. A cornfield where the cultivation is done largely with the horse hoe is generally if well manured and tilled a profitable crop, producing usually about 50 bushels per acre. About $20 per acre judiciously expended gets this crop ready for harvesting and the fodder from the stalks if properly saved pays this last expense. But with the present high price of labor I am inclined to think

that, unless the field needs reseeding, the farmer of our day will by applying his manure directly to his grass crop, receive enough more increase, so that he can better afford to *purchase* his corn. I would also say nearly the same of oats. If they were not a crop convenient for re-seeding they would be less grown here than even the present small quantity. They are even a very poor crop for that purpose, for to get a good catch of grass the field should be in good condition, with perhaps a top dressing of some fine manure or fertilizer added at the time of seeding; and this generally causes the oats to lodge badly. I have thought that very early sowing remedied this in part but not wholly.

The potato is more necessarily grown among us, the transportation of it being more difficult, and a considerable manufacturing interest creating a moderate demand; so it will be treated more in detail. No one has entered largely here into its production, but about every land-owner has his potato patch from one-fourth acre to two acres. On a farm of seventy-five acres I usually grow from one to two acres, producing from fifty to two hundred bushels to the acre according to the season and the variety. I find a loose porous soil the best. Some varieties like the Early Rose and Peerless depend for good quality very much on a proper soil, and it is for this reason there is so varied an opinion as to the value of these varieties; a slight difference in soil making them either of very good or very bad quality. Land that has been worked a season or two previous will usually produce a better quality than turf ground. A soil that holds water well either because it is stiff and heavy or because it contains much vegetable matter is not good; but a rich soil, very porous and naturally well drained, is most certain to produce a good and reliable crop. Peruvian Guano, Superphosphate of lime, ashes and a limited quantity of salt are good fertilizers. Barn yard manure if partially decayed is also very good. Use enough fertilizers of some kind to make the plants grow with vigor, but avoid those of a heating or fermenting nature as far as possible, if you want a good crop free from disease. I plow and harrow my ground well, and furrow it out with a Shares

horse hoe (with the teeth removed) for the rows. I then cross mark with a light hand marker and drop and cover the potato sets at the intersection, making rows both ways about two and a half feet apart. Most varieties I find produce a larger portion of marketable potatoes by using large or medium sized tubers cut from two to four eyes and one piece in a hill. Early planting generally succeeds the best. When about half have pushed their sprouts above ground I like to go over the field with a good bush harrow and thus destroy the first crop of weeds which by that time are generally just out of the ground. After this and until the tops get too large I do nearly all the cultivatioh with the horse hoe, it being so arranged that by going between the rows both ways of the field, I can hill up the plants as may be desired. But in order to avoid having large weeds to pull at the time of digging it is usually necessary to go through the rows some two weeks after the last time cultivating, and pull or destroy such as may show themselves in or by the side of the hills, which the horse hoe did not disturb. I have never tried any of the potato diggers, but have found Hexamer's prong hoe the most efficacious implement, if rightly used for taking out the crop. I prefer to have the potatoes get pretty well dried before removing to the cellar; often, if the nights are not frosty letting them lie till the next day before picking up. If they lie too long the quality will be injured, but Early Rose can be left out three days or more without injury. Varieties liable to rot if wanted for seed can be almost entirely preserved by leaving them scattered in the field a week or two and then removing to a dry cellar. After potatoes for the table or market are placed in the cellar, they should be kept in the dark as much as possible, otherwise their quality will be seriously injured. The varieties are so numerous and so variable that it is difficult to decide upon the best. The Peachblow perhaps is the best winter variety that has been well tried. The Colebrook Seedling is also generally satisfactory. For an early variety I think it will be long before the Early Rose can be excelled. The King of the Earlies, although the tops die sooner, cannot on account of smaller

size be used much sooner and the quality is not as good. The Peerless, (Bresee's No. 6), a late variety, has so far promised well; when raised on the right soil, the yield is immense. The Concord I regard as another new variety of much promise. This is a seedling of the Mercer, produced in Delaware Co., Penn. The quality with me is good, and the yield and hardiness I think superior to the Peachblow. The Late Rose, a variety said to have been selected from the Early Rose, is the novelty offered by the seedsmen this season. Whether it will produce the potato mania caused when the Early Rose was introduced remains yet to be seen.

T. B. Wakeman, Westport.

Wheat: variety—red or Mediterranean, mostly sowed after potatoes with top dressing of fine manure or ashes. I have raised 35 bushels per acre. Average yield in the town, 22 to 25 bushels per acre. Very little rye, oats, barley, or buckwheat raised, and of corn not one-tenth what is used in the town. When our meadows want plowing we turn over the turf and plant corn, and the next year potatoes, and seed in the fall with wheat. We never fail to have the grass seed take. I never shall plow in any more manure but always harrow it in, unless very coarse. We get from 30 to 60 bushels per acre. Average, 30 bushels.

Potatoes are raised in large quantities. Average yield 130 bushels per acre. The Early Rose is most largely planted. The Peerless, a late potato, yields most abundantly. Some have got as high as 400 bushels per acre. Generally planted after corn or on turf land.

Onions are the principal crop with us. Average yield per acre, 500 bushels. Raised in the town of Westport, from 300,000 to 400,000 bushels, the highest yield being 900 bushels per acre. The price this year was about 60 cents per bushel. For two or three years back they have averaged two dollars per bushel. This year they only about pay expenses.

For their successful culture the first and most important item is the seed.

It is very important to know what kind of onions it was

raised from. In other crops we can generally tell by the looks of the seed whether it is good or not. Not so with onions. It is impossible to tell by the looks of this seed whether it will raise scallions, or the flat onion, or the round deep onion, which is mostly raised in this section.

I raised the flat onion when I first commenced the business. They will not yield one third as much as the round onion; so we cannot judge what the result will be if we do not know what kind of onions our seed was raised from. We have, by selecting the large, round, deep onion from year to year, improved our quality and quantity, so that we raise six to nine hundred bushels where we once raised not more than three to five hundred bushels. We select the most solid, largest, deepest, and brightest for seed. Seed-onions should be kept from freezing. A light freezing will sometimes injure the chit, or germ.

The best ground for raising them is level land with a deep soil, free from stones. But I have raised them successfully on gravelly soil and quite stony. I prefer, however, a deep, loamy soil. I would plant the ground with corn or potatoes —I prefer corn—one or two years. It should be highly manured, and not a single weed allowed to go to seed. When the corn crop is gathered, prepare the ground in the fall for next year's crop of onions, by putting on twenty cart loads of well rotted manure, fifty bushels to the load, per acre. It should be free from weed seed, and ploughed in deeply and not harrowed in the fall. I have ploughed my ground both spring and fall, manuring at the same time. It is not more than half the work in the spring to prepare ground for the seed that was ploughed in the fall, and the yield is as good if not better. Hog manure is the best, but any kind of strong manure will do.

All manure should be free from seed. Manure, either fine or coarse, should be ploughed in deep. If ashes are to be had, put on one to two hundred bushels to the acre. The crop of onions will pay for them the first year, and they will last from five to eight years. Bone dust is a fine manure. The ground in the spring should be prepared for the seed as

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soon as it is dry, by harrowing with tooth and brush until the ground is level. It will not do to have the ground too mellow. It should be rather hard to have the onions bottom well. It needs to be very mellow about an inch deep, and raked off level.

It requires from three to four pounds of seed to the acre. I sow them by a machine made very simply and costing from two to four dollars. It sows two rows at once, twelve inches apart, the wheels being six inches from the hoppers that drop the seed. The first row must be perfectly straight, which will be a guide to the second and so on. To cover them up, I take a hoe that stands in well, and push it along over the line where the seed is. When they get up so that I can see the rows, I commence hoeing them, and as soon as there are any weeds to be seen weed them, and continue to hoe and weed as long as there is a weed to be seen. It will not pay to sow a piece of onions if they are not well taken care of, and no crop pays better if well tended. There are some farmers that lose one-third or more of their crop by not taking proper care of them, and letting the weeds grow after the onions have attained some size. If one intends to raise them year after year on the same piece of ground, (and they will grow as well by heavy manuring as they did the first year,) he must not let a single weed go to seed. If the right kind of seed and plenty of manure are used and the ground cultivated as it ought to be, we may expect from five to eight hundred bushels to the acre. If the ground is free from weeds, as it should be, when the crop is gathered in, so much the better for next year's crop. When most of the onions get ripe, I let them dry one or two days, and when dry rake them in windrows, pile them up in small heaps, and let them stand till they have no moisture in the top. When it comes a drying day spread them out, and when perfectly dry cart them in. They can be kept from two to six feet thick if they are well cured and put where the air can circulate around them till very cold weather, and then they must be kept from being frozen too much.

It seemed to me the hardest work that I had ever done to

weed the first piece I planted, and it cost more to cultivate my first two rods of ground than it has an acre since, owing to the ground being full of foul seed. Onions are the most profitable crop that a farmer can raise, and the quantity has been increased from three hundred to nine hundred bushels per acre, and I think one thousand bushels or more can be grown by proper cultivation.

No tobacco, broom corn, or beans raised; quite a large quantity of carrots and some turnips.

Some farmers are trying to raise small fruits for New York markets, but it is a new business for us. Some think it pays better than most other crops.

Strawberries raised in Westport, about 70,000 quarts. Currants, 50,000 pounds. Raspberries, 10,000 quarts. Grapes, 50,000 pounds. This estimate of the quantity of small fruits is probably low. Market gardening is receiving some attention.

	Highest yield per acre.		Average per acre.		Number of acres in Westport.
Wheat,	35	bushels.	22	bushels.	100
Rye,	25	"	14	"	50
Oats,	50	"	30	"	200
Barley,					
Buckwheat,	25	"	20	"	40
Corn,	60	"	30	"	300
Potatoes,	300	"	120	"	400
Onions,	900	"	500	"	700
Beets,	1000	"	600	"	100

W. A. Strong, Secretary Woodbury Agricultural Society, Woodbury.

In reply to your circular. It is very difficult to get at anything certain in regard to crops. The usual answer to my enquiries is "I don't know." I can only give you the particulars in regard to my father's (A. C. Strong) farm.

Wheat, none raised.

Rye, sown after potatoes, straw about seven feet high. Yield, about one bushel to shock. Weight of straw, about 100 pounds to shock, 25 shocks to acre. Land rich and has been well manured.

Oats, fair; yield about 37 bushels to acre. On same kind of land as rye.

Barley and buckwheat, none.

Corn, on good land well manured, manure harrowed in, yield small. Not yet picked. Should estimate yield about 50 bushels to acre, about two-thirds our usual crop.

Potatoes, on good land after corn, land harrowed down smooth and planted on level, yield about 150 bushels per acre.

Onions, none. Broom corn and beans, none.

Tobacco, 1 acre, yield estimated about 1,500 pounds per acre. On turf well manured and harrowed down, kept free from weeds. Planted two feet by three.

My business confines me at home (merchant) and I have not time to look up all the information I would wish to give you. There is not one in twenty can give any definite information in regard to crops, and it is rather up-hill work to guess at it on your own hook.

R. S. Hinman, Riverside.

Wheat is grown with us but to a limited extent, as our mills are not adapted to making good wheat flour. Rye is grown quite extensively. The straw sells readily for cash, sometimes higher than hay. The average yield is about eight bushels, though it might be much more. Most of our farmers use no manure on rye as it will grow on thin land without, but I think this a great mistake. I prefer it to any other grain crop to seed down with for meadow. I would rather have ten loads per acre of barn yard manure harrowed in with rye, than thirty loads applied as most of our farmers do before planting corn, to be followed by a crop of oats and then meadow. My rye is mostly grown on land that needs renovating. My plan is to cut brush when the ground is frozen if possible, and early in spring haul off loose stones if there are any and plow. Cross plow in June and again in the last of August. Sow the first of September. I plow my rye in making four plowings, then apply the manure and harrow, after which I sow timothy and red top and harrow again, the fol-

lowing spring I sow clover. I have four acres from which I cut a fair crop of rye the past season, that will be good meadow next year. I worked it by the above plan at an expense of about $16.50 per acre not including manure. It was absolutely valueless to begin with, and the rye paid part of the expense, consequently the investment will be a good one. I have failed to find any market manure that seems to pay on rye. They all seem too quick in their effect. I shall try bone next year at the rate of a ton per acre.

Oats are generally grown after a crop of corn or potatoes. They are supposed to draw on land more than rye, but that does not deter farmers from sowing them. Average yield about twenty bushels per acre.

Buckwheat is grown to some extent, but there is a strong prejudice against it, as it is thought to leave land cold and unproductive. Properly managed however this crop may be safely and profitably grown.

I plow but once, commencing in June as opportunity affords. Sow from 1st to 15th of July. To insure a crop apply a little phosphate or guano. Next spring will find the turf nicely rotted and in condition for planting corn or potatoes.

If improving the land is the main object however, let it lie till late in June without pasturing, and repeat the process of turning under what grass has grown. In this way a paying crop may be annually raised and the land enriched by the crop turned in, continually grow better. I sowed clover seed the past season on five acres with buckwheat and shall sow it with buckwheat, turning in the clover next season. Average yield about twenty bushels, although I have grown as high as forty bushels per acre. Corn is still grown on most farms but not as extensively as formerly. I consider it questionable whether we can grow it in Connecticut profitably. Our average yield is about thirty bushels per acre.

Potatoes are grown with us as a market crop, Early Rose, Garnet Chili, and Peach Blow being the leading varieties. The yield is from one to two hundred bushels per acre. They generally sell for about three quarters as much as corn, and

as the yield is more than double and less manure is required they are much more profitable. Turnips are grown to some extent, but not as much as they should be, White French and Yellow Aberdeen or Stone, are the popular varieties. Where land cannot be got into good condition for seeding with oats in the spring, I sow grass seed with turnips any time in July with excellent results. I sow the Yellow Aberdeen, as I greatly prefer them to the hoed varieties. I can feed them to milch cows without injury to the milk, and I like them better for fattening stock.

W. H. Yeomans, Columbia.

Estimate of acreage and yield of farm crops in Columbia, is as follows :—

Wheat, none to my knowledge.
Rye 50 acres, 15 to 20 bushels per acre.
Oats 350 acres, 25 to 40 bushels, premium crop 73 bush.
Barley 10 acres, 30 to 40 bushels per acre.
Buckwheat 150 acres, 25 to 35 bushels per acre.
Corn 300 acres, 40 to 60 bushels per acre; premium crop last year 93 bushels.
Potatoes 200 acres, 100 to 150 bushels per acre.
Onions 15 acres, 300 to 400 bushels per acre.
Tobacco 20 acres, 1800 to 2000 lbs. per acre.
Sorghum 5 acres, 3 to 5 bbls. syrup per acre.
Beans 15 acres, 20 to 30 bushels per acre.
Turnips 10 acres, 400 to 500 bushels per acre.
Carrots 5 acres, 600 to 800 bushels per acre.

S. B. West, Columbia.

Rye.—White. Usually upon new or turf land, plowed in the spring and cross plowed in fall. Phosphate, bone or Peruvian guano 100 pounds per acre. Time of sowing from September 1st to November 1st. Harvesting 10th to 25th July. Acres by me two, (in town thirty,) twenty-six bushels per acre. Average product per acre, eighteen to twenty bushels. Cost sixteen dollars per acre. Value one dollar

twenty-five cents per bushel. Straw twenty-five dollars per ton.

Oats.—Common State, Norway and Surprise. Sowed as soon as ground will admit, late sowed oats are usually very light. Number of acres by me four, in neighborhood thirty-five. Average product per acre twenty-two bushels. Cost eight dollars per acre. Value fifty-five to sixty cents. Straw fifteen dollars per ton for feed. Common State have given the greatest satisfaction this year.

Corn.—Different varieties mixed, viz: Large Yellow, Small Yellow, Cap and White Cap. Planted upon sward and after potatoes and buckwheat. Manure usually plowed in upon old ground from twenty to thirty loads per acre, and manured in the hill with half shovel of well rotted manure, or with phosphate in hill, four to five hundred pounds per acre. Upon swardland fine manure harrowed in, and usually planted with phosphate or compost in hill. Rows three and a half feet apart, distance three feet in the row, large kinds require more, and small kinds less distance. Usually cultivated or hoed but twice. Mostly cut from the hill to cure in shocks,—which mode I prefer to cutting stalks—making sounder and heavier corn. By myself four acres, in neighborhood thirty acres. Average product per acre twenty-five bushels. Cost seventy-five cents per bushel. Feed and market value ninety-five cents per bushel.

Buckwheat.—Sowed upon sward land with fertilizers, yield fifteen to twenty bushels per acre.

Potatoes.—Early Rose. The culture of all kinds of potatoes are nearly alike, although I am satisfied that the Early Rose requires much richer ground than any other kind, usually planted upon old ground frequently with nothing but fertilizer in hill, I usually get fair potatoes in this way. The present season I planted but two kinds, Early Rose after tobacco with a spoonful of Bradley's X. L. Phosphate in hill. Two hundred and five bushels from seven-eighths of an acre. Cost twenty-five cents per bushel, market value fifty cents per bushel. Prince Alberts on very light soil, treatment same as Rose, cost twenty-two cents per bushel, eighty bushels on three-fourths of acre.

HENRY E. LYMAN, COLUMBIA.

In answer to your circular in regard to varieties of crops raised, I would say that this town has as diversified a number of crops as any in the state.

Among the crops relied upon as staples, are corn, potatoes, oats, buckwheat and onions. Comparatively little is done in raising tobacco, though this year marks a decided increase in this crop. Beans are not grown to any extent. Rye and barley cannot be said to have very general cultivation. No broom corn is raised. Root crops for feeding are not general.

My corn this season is medium, not a heavy yield. Oats heavy and large yield, mostly common white oats; my oats are good, better than for years, from one and a half acres sixty and a half bushels. Corn, acreage one and three-fourths. No buckwheat or tobacco. Onions good, yielding three hundred and fifty to four hundred per acre, with light manuring on new ground; last year was corn where I grew onions; eight loads of barn yard manure on fifty five rods of ground; one bushel salt all the fertilizer when sown. After third weeding fifteen bushels of ashes. Potatoes fair to good; my ground suffered from the dry weather early in the season, my crop about one hundred bushels on one acre. Early Rose and Chili's the varieties grown. The Early Rose requires extra care and extra fertilizing to produce an equal amount, thereby proving uncertain when put upon ground not in excellent heart. In this some cultivators may not agree with me.

As regards corn, my experience is that late fall ploughing of sward land is most beneficial in two points of view. 1st. It removes worms that infest land turned over in the spring. 2d. There is such a chemical change working in soil exposed to winter weather, that it produces just the right condition of things to insure an early crop.

My formula therefore is: for corn deep late plowing, medium spring turning, with cross harrowing. This is all the preparation necessary.

Oats are undoubtedly better when ground is left in fall in ridges, besides saving much time in press of labor.

D. H. Willard, Newington.

Wheat, red or Mediterranean. Not raised much excepting now and then an acre. Sowed after the tobacco crop, is taken off in September or October. Yield, 20 to 30 bushels per acre.

Rye, Jersey White. Sowed last week in August or 1st of September. A crop of Red Clover is generally turned in and no other kind of fertilizer is often used here. Yield from 15 to 25 bushels per acre; highest, 30. The straw sells for $30 per ton in Hartford, and pays all the expense of raising. I have 14 acres sown this fall. Number of acres in town, not far from 400. Value, $1.25 per bushel for feeding.

Oats, common white, Norway and Surprise. Generally sown in April on land that has been in corn or potatoes the previous year. I have raised 16 acres the past season. Number of acres raised in town, about 500. Average yield, 30 bushels; highest, 50 bushels. Straw when in good condition worth for fodder, $15 per ton. Oats worth 65 to 70 cents to feed.

Buckwheat, mostly sown on poor land or on some bush pasture recently broken up. Fertilizers—bone dust, guano, or phosphate. Sown in July. Generally cut in October. Average yield, 25 bushels per acre: highest, 40 bushels.

Barley and broom corn, not enough raised for any estimate.

Corn; Canada, Early Dent, Sanford, and eight-weeks yellow. Planted in May, on land that had been in rye the year previous, but of late years more frequently on inverted sod, with some 20 or 25 loads of long manure per acre, well plowed in and then rolled and harrowed; then marked out in rows both ways, about 3½ feet apart; small handful of some concentrated fertilizer in each hill, cultivated or plowed between the rows and well hoed three (3) times. Cut up in September before frost and well stacked with two good straw bands drawn tightly, one near the centre of the stack and another

near the top, which should be bent over before tying last band to form a kind of cap to prevent rain from running down the centre of stack. Value per stalks for fodder, $15 per ton. Average yield corn, 40 bushels; highest, 75 bushels. Value per bushel, $1.25. Number of acres in town, 200. Have raised eight acres this season.

Onions, white and yellow. Sowed in drills 16 inches apart on good land well manured with fine rotted compost, say 30 loads per acre. Hoed and weeded three or four times. Average yield, 150 bushels per acre; highest, 200. Value per bushel, $1.00. Acres in town, 40.

Potatoes; Early Rose, King of Earlies, Chili, Peerless, Peach Blow. Planted in April, rows 3½ feet apart, 16 inches in rows; plaster or fish guano in the hill. Plowed and hoed as often as once in ten days until the vines fall. Dig in October the late varieties. Average yield, 100 bushels; highest, 250 bushels. Have raised 6 acres. Number of acres in town, 300. Value per bushel, 75 cents.

Tobacco, seed leaf. Plants set in June or July in rows 3½ feet apart, 20 inches in the rows. Fertilizer, guano under the hill; plow in all the fine manure that you can cover. Hoe and weed, and worm and sucker unti it is ready to cut in August or September. Hang on laths until cured. Average yield, 1,500 pounds per acre; highest, 2500 pounds.

Mangolds, sugar beets and long or Yellowstone turnips yield 200 to 1000 bushels per acre, worth 25 cents. No grass or other seeds raised.

Wm. S. Babcock, Plainfield.

I grow on my farm corn, oats, and potatoes. I do not plant to exceed four acres of corn and potatoes each year. Corn yields about 40 bushels per acre, oats about the same, and potatoes, 150 bushels. Rye about here yields from 5 to 20 bushels per acre, barley in good seasons about the same as oats, buckwheat produces from 5 to 25 bushels per acre, but I never raise it, or wheat, onions, or tobacco. Where I am to plow for planting I spread on fifteen loads of manure per acre,

turn it under with the plow, then spread on as much more and harrow thoroughly. Corn and potatoes to do well should be planted by the 15th of May.

I do not think there is much gain in plowing and planting corn and potatoes. It has been an old time-honored notion with many men that the plow must be kept going, the acres plowed up and cropped year after year, or they are not doing much at farming.

I have for some years turned my attention to the hay crop, because it pays better than anything else when we are not too far from market. It has been my opinion for some time that we must look to the West for our corn and pork, and turn our attention to something that will pay better.

J. S. Allen, East Windsor.

Of the list of crops contained in your circular, barley, buckwheat, onions, broom corn, beans, and root crops are not much raised.

Wheat is sown after tobacco in September and large crops are obtained, from 25 to 40 bushels per acre. Fifty acres are raised in town. Rye is sometimes sown after tobacco, and 30 bushels per acre are often obtained. The old, worn out fields that are often sown to rye do not produce much. Five bushels to the acre would be a large average; about 200 acres are raised in town. Oats are generally sown after corn and potatoes, and from 15 to 25 bushels per acre obtained. About 300 acres are raised in town.

Corn is cultivated with more care and larger crops obtained than formerly. The manure is generally put in the hill. Tobacco stalks placed in the drills are a fine manure for corn or potatoes. Fish is used, also ashes and plaster, bone-dust, and a compost of fish and muck. All of these have been used with good results. I have heard of 80 bushels per acre being raised; probably the crop will not average more than 30 bushels per acre. About 800 acres in town.

Potatoes are largely cultivated, though not very many are sold. Early potatoes are sometimes raised for the market.

The Early Rose is a universal favorite. I have heard of 400 bushels per acre; 100 bushels per acre will be nearer the average.

Tobacco is the staple in this town, and to its production all the skill and means of the farmers are devoted. Every sort of manure is used and in almost every way. Drilling is fast gaining favor, and with a well prepared compost is undoubtedly the best. Nearly 300 acres are raised in town, and will probably average *this year* 1800 pounds per acre.

Grass, clover, and vegetable seeds are not raised for the market, and in fact not much raised any way.

No market gardening to speak of. I think I can see a marked improvment in the mode of culture and in the amount of production per acre of the crops cultivated.

Amasa Morse, Union.

Notwithstanding nearly all our people own the farms they live on, yet very few of them live principally by farming. There is probably raised in town yearly about 120 acres of corn at an average yield of 30 bushels per acre, 150 acres of potatoes at a yield of 150 bushels per acre, 120 acres of oats at 25 bushels per acre. There is occasionally a piece of buckwheat at about 20 bushels per acre, occasionally a piece of rye at from 10 to 25 bushels per acre. A few raise barley instead of oats, and get from 20 to 30 bushels per acre.

There is rarely any wheat, tobacco, or broom corn raised. Very few roots or onions.

Our principal crops are corn, potatoes, oats and grass. Various modes of preparing the ground and raising these crops are practised. My own course is the following. If I raise buckwheat I plow a piece of sward land in the spring if I have not done it the fall before, harrow it, sow on a bushel of seed and 125 pounds superphosphate of lime, and harrow it in; generally get 20 bushels per acre. The next year follow it with potatoes by plowing the ground, manuring in the hill with green stable manure from cattle, rows 3½ feet apart, hills in row 2½ feet; generally get about 200 bushels per acre.

The next year I follow with corn by plowing the ground, then spread 20 to 25 cart loads of manure, plow again and use as much more well rotted manure in the hills, rows 3½ feet apart, hills 3 feet; hoe twice, three times if I can get time. As soon as the corn gets glazed quite too hard to boil I cut it up and stack it, and husk as soon as it will do. For a number of years past I have averaged 50 bushels of shelled corn per acre. The next year I follow with oats or barley and lay it down to grass. I have generally got from 25 to 40 bushels to the acre.

I have not generally planted more than an acre of each crop per year. My principal crop is grass raised on land that I do not plow at all, by top dressing it in the fall with about 20 cart loads of manure per acre about once in two or three years.

What rye is raised in town is raised on land newly cleared. The brush are burnt off; no other preparation is necessary; the rye is sowed and harrowed in.

E. C. Holmes, West Winsted, Winchester.

Wheat, barley, onions, tobacco, broom corn, I think are not raised at all, or not to any extent in this town that I know of. Wheat and tobacco a few years since were raised to some extent, but for some reason they are abandoned or nearly so. The facts are, this town is not a grain growing town, the soil, climate, and situation or make of the land are not such as to make the raising of grain to any considerable amount profitable. Grass is, and will be more, the main crop in this section, and until farmers can make or procure, in some way, manure sufficient for their grass ground and some to spare, they cannot afford to plough only so far as is necessary to improve the soil for raising grass. So far as my experience goes manure used as top dressing where land is tolerably smooth or does not need leveling, is much more profitable in improving the soil or increasing the grass crop, than when applied to crops, considering the extra labor necessary in raising grain or tobacco, and the tendency in these crops to consume

the manure and consequently to reduce the strength of the soil.

The great question for farmers is manure; plenty of manure will produce good crops of all kinds, and nothing else will.

Farmers in this section are getting more in the way of raising roots to feed on the farm since the way is opened for selling milk, and this tends to improve and increase the manure heap.

My opinion has been for some years, and I think that the opinion is gaining ground in this vicinity, that we can buy our grain cheaper than we can raise it.

Oats are raised mostly as a crop to seed down with and not so much for the profit of the crop. My practice is to seed down with oats and grass seed, and mow the oats for hay before ripening to avoid the absorbing of the strength of the manure or soil in ripening the seed, and also the smothering of the grass by lodging if the ground is rich.

The most important root crop raised in this vicinity is what we call Rock Turnip, the white variety. The most reliable seed we can get is raised by Messrs. C. B. and R. Phelps, of Colebrook. They are valuable for feeding or for family use.

Thomas A. Mead, Greenwich.

Wheat is raised by a majority of our farmers in quantity sufficient to supply them with bread; average yield 22 or 23 bushels per acre. Ground thoroughly prepared, and about ten thirty-bushel loads of fine manure put to the acre. Time of sowing, middle of September.

Rye only raised for home consumption; yield, 18 bushels per acre.

The yield of oats is very uncertain, varying from 20 to 80 bushels per acre, as they are much affected by the season.

Barley, none. Buckwheat, very little.

Corn is our most reliable crop. When the ground is well prepared and the tillage good it varies but little in yield from

the effect of season, not to exceed ten bushels per acre in my experience.

The yield per acre is from 30 to 80 bushels; the difference in yield is due to manure and tillage. We have instances of 10 bushels, again of over 100 per acre.

Potatoes are planted after corn, averaging 150 bushels per acre.

Onions are raised in the southeast part of the town to a considerable extent, yielding 400 or 500 bushels per acre.

Tobacco, broom corn, beans and root crops are not raised in sufficient quantity to be worthy of notice.

H. M. Knight, (Lakeville,) Salisbury.

I am poorly fitted to reply to your questions, so far as speaking for others.

I raised the last year,

Potatoes,	100	bushels	per acre.
Corn,	25	"	"
Oats,	30	"	"

Carrots, about 30 tons per acre.

My oat ground was good, but the crop was not good.

My corn and potato ground was very poor and I planted it as much for the sake of the ground as for the crop, using what manure I had. I have inquired carefully, and the general testimony is that corn will average 50 bushels per acre, potatoes 100, and oats 30.

Hay was very light.

I have ploughed several acres and seeded again with timothy for a hay crop next year.

The grass roots were killed by the dry weather, and in most of our old upland meadows there can be no good crop of grass again until seed is sown. I sowed my grass seed for a crop next year in the early days of September.

The Farmers' Club of West Cornwall report the following acreage and average of the principal crops in Cornwall.

Rye,	130 acres,	12 bushels per acre.	
Oats,	300 "	30 "	"
Buckwheat,	70 "	12 "	"
Corn,	300 "	30 "	"
Potatoes,	250 "	120 "	"

B. H. Andrews, Waterbury.

I give you the result of my experiment in hybridizing corn the past season. The varieties were the Early Prolific, Vermont Hybrid, both early varities, and Ohio Dent. The early varieties I mixed in the seed, and the result was satisfactory. The Ohio Dent I planted in the same field side by side with the other varieties, but it appeared to make no impression towards amalgamation with them. But the result on the Dent corn was very marked, producing much longer ears with a perfectly smooth, hard kernel, beautifully mottled with white and yellow.

My method of cultivation is different on different soils. On a strong turf I spread manure broadcast, then ridge it by turning two furrows together, beginning on the upper hillside so as to leave little or no balk; that turns the manure into the row where the roots reach it at a time when most needed to fill out and mature the ear. Plant 2½ or 3 feet apart, 3 kernels in a hill, lengthwise the ridges; cultivate lengthwise without breaking the ridge. When the soil is mellow proceed as before and plant across the ridges 4 feet apart, 4 kernels to the hill; cultivate both ways, as it is easier to keep the ground clean.

D. H. Birdsey, Middlefield.

	Cr.
Tobacco, 1¾ acres, 4188 lbs. sold for	$1268.00
Tobacco stalks worth	10.00
	$1278.00

	Dr.	
Estimated cost of raising,		
35 carts of manure, at $8,	$280.00	
15 hundred guano, at $4,	60.00	
Poudrette,	20.00	
Labor,	350.00	
Interest on land,	12.00	
		722.00
	Net Profit,	$556.00

	Cr.
Wheat, after tobacco, one acre and fifty rods,	
53 bushels wheat at $1.60 per bushel,	$84.80
3 tons straw at $15,	45.00
	$129.80

	Dr.	
Seed, three bushels at $2.50,	$ 7.50	
Plowing, harrowing, &c.,	6.00	
Harvesting and threshing,	25.00	
Interest on land,	8.00	
		46.50
	Net Profit,	$83.30

D. B. Miller, Middlefield.

Buckwheat, 2¼ acres; land worth $40 per acre. Plowed about the first of July, sod turned under, harrowed three times.

	Cr.
75 bushels buckwheat at 85 cts.,	$63.75
One ton straw,	7.50
	$71.25

	Dr.	
Plaster and Guano ground together, 4 cwts. each,	$15.75	
Seed, three bushels,	3.00	
Labor,	22.50	
Interest on land,	5.40	
		46.65
	Net Profit,	$24.60

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P. M. Augur, Middlefield.

Onions, one-third acre,		Cr.
150 bushels at 75 cts.,		$112.50
25 bushels carrots at 40 cts.,		10.00
		$122.50
	Dr.	
Manure,	$40.00	
Plowing and raking,	4.00	
Seed,	9.00	
Sowing, cultivating, and marketing,	30.00	
		93.00
	Net Profit,	$29.50

Carrots, one-sixth acre,		Cr.
40 bushels at 50 cts.,		$20.00
	Dr.	
Plowing and sowing,	$2.00	
Seed,	1.00	
Manure,	5.00	
Cultivation,	8.00	
		16.00
	Net Profit,	$ 4.00

A part of the seed did not come up well.

J. M. Hubbard, Middletown.

Naming the cultivated crops raised for market in this vicinity in the order of their importance, I should make the list about as follows: Tobacco, Potatoes, Turnips, Onions, Buckwheat, and Beans. The last three named are raised but by few parties and in small quantities, while of the others named in your circular, it is exceedingly rare that any are raised for market. Of the crops upon which dependence is placed for an income, tobacco is first in importance. Requiring though it does the best soil, the most liberal fertilization, and the most unremitting care, the judgment of those who give it

all these things, is practically unanimous that no other crop pays so well. It would be tedious to write out at length the details of its treatment, and in regard to some of them successful cultivators differ considerably. But all agree that the soil must be warm and loose, that it must be prepared by thorough pulverization and very liberal manuring, and that whatever else on the farm is neglected the tobacco crop must be cared for thoroughly and at the right time. For fertilizing barnyard manure is the main reliance, but no kind of fertilizer that acts promptly comes amiss. After the plant recovers from the shock of transplanting it grows very rapidly, and the care and labor of the cultivator can hardly be intermitted for a single day until it is safe in the curing sheds. For fast as the crop may grow the weeds will keep pace with it if permitted, and cut worms and leaf worms will harvest the unripe crop for you unless a war of extermination is waged against them. And as the value of the crop lies in the leaf, its tendency to mature seed must be sternly repressed by "topping" and "suckering". Good judgment and experience are necessary in determining just where to break the top, the object being to leave upon the plant those leaves and only those that will grow to fair size and be of good quality.

When the crop is ripe, a point involving some practical knowledge for its determination, it is to be cut, wilted slightly, then moved to the curing sheds, and hung therein with as little bruising and breakage as possible. The largest sized plants require about a foot square of space horizontally, by five feet in depth, to cure safely. The usual practice is to give them air very freely at first, diminishing the exposure as the curing process goes on. When it is thoroughly cured, advantage must be taken of all damp spells of weather to take it down, strip off the leaves, and sort them for market.

I am not able to give much of the statistical information asked for in your circular. I should judge an average crop of tobacco to be sixteen hundred pounds per acre. Of this twelve hundred pounds should be "wrappers," and four hundred "seconds" and "fillers." At 30 cents for the wrappers and 8 cents for the balance, this would yield $392 per

acre. The cost of such a crop I should figure about as follows:—

Rental of land, - - - - -	$15.00
Manure, - - - - - - -	75.00
Labor, preparing ground, - -	10.00
6000 plants, - - - - - -	9.00
Setting out, - - - - -	12.00
Hoeing three times, - - - - -	12.00
Miscellaneous care, - - - -	25.00
Harvesting, - - - - - -	40.00
Stripping, &c., - - - - - -	40.00
Rent of curing sheds, - - -	40.00
	$278.00

The estimate for manure is only for the amount supposed to be consumed by the crop. It allows about 1000 plants for resetting, and presumes favorable circumstances attending the operations throughout.

The tobacco crop is so exacting that whenever its culture is adopted it makes every other crop incidental.

Of course every farmer raises potatoes and turnips for home consumption, and there is usually a surplus for market, but the methods of culture are old and the crop receives comparatively little attention.

W. H. White, South Windsor.

I have no accurate statistics from which I can deduce statements concerning the exact number of acres devoted to any one crop in this town; therefore my estimates will be taken only as approximations to the real number. Most of the grain, root crops, beans, potatoes, onions, &c., are merely grown for family supply; a large proportion of the farms have a small patch, or a few rods, devoted to most of the varieties embraced in your circular.

Wheat is grown by only a few farmers, amounting to perhaps a dozen acres in the town, the most grown by any one farmer not exceeding one to two acres. This is mostly sow-

ed after tobacco, first plowing the ground during September, sowing the seed broadcast and harrowing in, from the 20th of September to the middle of October. Seldom is any fertilizer applied when sown after tobacco, the soil being sufficiently rich to produce from 25 to 30 bushels per acre. Winter wheat is only grown of the bearded white varieties. Harvesting is done in July, cutting with the grain cradle or sickle. Rye is more generally grown and in greater quantity; two-thirds or three-fourths of the farms have half to ten or twelve acres devoted to rye; the smaller area is sown after tobacco, this ground producing from 30 to 40 bushels per acre; after corn 20 to 25 bushels; plain or old fields from 10 to 15 bushels per acre. The whole number of acres grown in town I could not approximate by estimation. On our own farm after corn we produced 28 bushels from an acre the past season without extra fertilizing or any application to the crop. Old field lands are plowed and the rye sown in September broadcast and harrowed in, seed at the rate of 1½ bushels to 2 bushels per acre; one plowing is all usually given to any soil for rye; after hoed crops the seed is put in some time from the last of September to the last of October, at the rate of three pecks to one bushel per acre. Harvested same as wheat one to two weeks earlier.

Potatoes have been grown in greater abundance the past than for several previous seasons. From half an acre devoted to this crop, plowed once in spring and fertilized in the hill with a double handful of chopped tobacco stalks and one medium sized tuber to the hill, three times hoed, we obtained in round numbers 80 bushels free from rot or disease, planted the first week in May. Digging is done with the potato hook, picking and assorting by hand during the last week of September. So far as I am able to learn, the average yield of potatoes would not exceed 100 bushels per acre; very few plant with a view to marketing, only selling where a surplus is had where a family supply is exceeded when providing for contingencies. The main or only root crops grown are turnips, and these mostly for family use, very few for feeding to stock. Soft turnips are the main variety, although some ru-

tabagas, &c., are grown. Soft turnips are sown on well fertilized fallow or after some grain crop, sometimes among other crops in vacant places, broadcast, the last week in July. Tobacco has been produced in much greater area and quantity the past season than ever before. A wild statement has been the rounds of the papers as to the area devoted to tobacco in this town; the whole number of acres as near as I can approximate would fall below 400, not to exceed one-half the newspaper statements; that will give about one acre to each male inhabitant in the town. The mode of culture with our best growers is to spread broadcast and plow under about six inches 10 solid cords of stable manure, well fined when spread, in April or before corn planting. A few days before time for transplanting the ground is well plowed again some two inches deeper, thoroughly harrowed, and then the rows laid off, 3 feet 10 inches apart, by a small plow. Into these furrows is strewed guano and plaster mixed, at the rate of 200 lbs. guano to 300 lbs. of plaster to the acre, and covered with a ridger and the hills marked 30 inches apart with a wheel marker in the centre of the top of the ridges. The plants are grown in plant-beds in a sheltered warm locality, in the richest soil, fine manure and guano being applied when the bed is prepared in spring, the surface of the bed being made as fine and smooth as possible, the seed sown broadcast at the rate of a tablespoonful to the square rod of bed, after being sprouted in fine soil or chip dirt, fine rotted wood or the like. The bed is kept clear of weeds, and when the plant's leaves attain a breadth of two inches with good strong roots, first week in June usually, they are drawn and set in the field during a moist or damp spell of weather, setting the plants a trifle deeper than they grew in the bed. As soon as set or the next day they must be looked over to destroy the worms (cut worms,) and continue daily till the plants are out of their way. As soon as the plants take root they must be hoed and all missing places filled and kept so. Two or three dressings with cultivator and hoe must follow according as the soil may need. Green worms must be kept off from the time they come, fore part of July, till the crop is

harvested. Topping is done when the plants show blossom, breaking off by hand down to where the leaves are six or eight inches wide; suckering is next, to keep off all branches shooting from the axils of the leaves, up to harvesting. When the tobacco is ripe, which is known by the change in color of the leaf, it is cut with a tobacco knife of some favorite sort, left on the ground to wilt so that it can be handled without breaking the leaves, then strung on lath, 5 or 6 to a lath, carried to the barn on a suitably arranged wagon, and the ends of the lath placed on scantling arranged for their reception, so that the tobacco will hang without crowding, that the air may circulate freely among it to cure it. Attention must be given to ventilation of the tobacco barn, that it may *cure* properly. When cured so that when damp no juice comes from the stem when crushing, or there are any green stems, &c., it must be taken down, bulked and stripped, assorting as stripped into wrappers, seconds and fillers, each sort done up in hands separately and so kept. A great deal depends upon the neatness and care taken in all the necessary manipulations of the tobacco crop for its selling qualities. Tobacco is sold in bulk or cased in boxes, 375 lbs. each, boxes 3½ ft. by 2½ ft. square, inside measure.

The yield varies greatly according to the soil and culture, from 1200 lbs. to 2500 lbs. per acre. Growers on the river road average about 2000 lbs. per acre, and for a few years past have sold to average 40 cts. per pound. From 1½ acres we received $1,574.80 last season. The culture of corn is similar to that adopted throughout the state, the main fertilizing being in the hill. An 8-rowed yellow variety is the kind generally raised; with very few exceptions the corn crop is subordinate to tobacco, the profits of one acre of tobacco buying the products of many acres of corn or other kinds of grain; yet nearly every farmer grows some corn, as well as other leading farm and garden crops. Our hay crops are sufficient to winter what stock we can summer and give a surplus for sale; especially is this true of the farms next the river. Considerable hay is sold from our meadows, the annual floods serving in good degree to keep up fertility.

WM. D. HALL, WALLINGFORD.

Strawberries. The soil is very light and sandy, 150 rods of land in the piece; it was well manured with fish guano and a good crop of tobacco taken off in 1869; the strawberry plants were set in the spring of '70; the land was marked out and the plants set 3 by 4 feet, were not kept in hills but the runners were allowed to root, except what were torn up by the cultivator, and the blossoms were picked off the first season. In September I cultivated in 1200 pounds of kelp fertilizer, this being all the manure I used on the piece. I kept them cultivated and hoed at short intervals until the 27th of September, and about the last of November spread a thin mulching of bog hay over them and let the plants come up through it in the spring; have not disturbed them by hoeing or cultivating since last fall. I took off the piece this spring 40,000 plants for my own use and to sell, and think I should have had more and better fruit if I had thinned them out still more. I had four kinds of berries, but most of them were Wilson's, a few rows each of Jucunda, Agriculturist, and Triomphe de Gand. For bearing and marketing I consider Wilson's far superior to any other, but for my own use prefer the Jucunda, though they cannot stand transportation. A late frost killed all the first blossoms, so that we did not get any fruit in market as early by a week as we otherwise should, and so missed the best prices, though we sold some at 40 cents in Boston and from that down to 13 cents. We picked off from the piece,

5128 quarts, sold for	$1,041.72
40,000 plants used and sold, at $3,	120.00
Total Receipts,	$1,161.72

Expenses, April 13, 1870:

Plowing and harrowing,	$ 4.00
4000 Plants,	12.00
Marking and setting,	12.00
Setting Missings,	2.00
Picking off blossoms,	5.00

1200 lbs. Kelp Fertilizer,	27.00	
Cultivating nine times to Sept. 27,	13.75	
Hoeing eight times to Sept. 27,	22.75	
Bog Hay for mulching,	10.00	
Spreading above,	2.00	
1871.		
Picking,	115.38	
Carting to depot,	16.00	
Freight to Springfield and Boston,	108.00	
Commissions and cartage in Boston,	74.67	
Use of crates and boxes,	20.00	
Use of land,	12.00	
Total Expenses,	$456.55	$456.55
Net,		$705.17

The labor is figured at the rate of $2.00 per day for man; for man and horse, $3.00; for man and two horses, $4.00.

Root Culture, by the Secretary.

In estimating the relative advantages of the culture of roots as food for farm stock, as compared with grain, or forage crops, various considerations should be taken into the account.

High culture and high manuring always make land better, and as it is only in this way that the cultivation of roots can be properly conducted, the tendency is always to improve the farm where it is practised. Again, though roots demand high manuring, yet being consumed on the farm they greatly increase the value of the manure heap, restoring in a shape most readily available to other plants not only organic matter but also that mineral matter which they have gathered from the soil.

As food for stock they have a value far above that which their chemical constitution would indicate. Not only is their nutritive material in the best shape to be assimilated by the animal, but they also assist in the digestion and assimilation of the other kinds of food consumed. A more healthy

growth of young animals is secured by the use of roots than grain.

The culture can be conducted in connection with the other operations of the farm so as to give regular employment to the whole force, and rarely to interfere with more important abors.

The produce from a given quantity of land is very large in comparison with most other crops, so that if we desire to carry the largest stock possible we must cultivate a share of roots. When properly managed the cost of culture does not exceed that of other kinds of cattle food.

These propositions which we have announced we believe will bear the test of examination and are sustained by the testimony of all those farmers who have given root culture a fair trial. They require that upon a well managed farm the culture of roots should receive its due attention.

Soil.—Any good soil will answer, either light or heavy, but as the amount of labor required is large, this will yield a better return when applied to a soil naturally productive. A light soil is more easily cultivated and the culture can be given when a tenacious soil would be too wet to work. A light sandy soil does not answer well for beets, but often yields good crops of turnips. By selecting the proper kind every farm may enjoy the benefits of a good crop of roots.

Preparation of the Soil should be deep and thorough. A well cultivated crop of corn or potatoes is a good preparation for roots. By all means so manage the field designed for roots that it shall not be full cf foul seeds to choke the young plants and increase the labor of cultivation.

I have known a rich, old turf, inverted just before planting, to be used most successfully. In this case well rotted manure should be thoroughly harrowed in and mixed with the soil after plowing. Use fermented manure or compost for carrots, beets or mangolds, finely pulverized, whether plowed under or harrowed in on the surface. Repeated plowings and harrowings, to secure its perfect admixture with the soil, are of the first importance. Ashes or superphosphate may be harrowed in and plaster sown on the young plants, espec-

ially turnips. For ruta-bagas we may use fresh manure from the cow stables or sheep sheds. Yarding sheep upon the field for a few nights just before sowing has a wonderful effect on light, sandy land.

Sowing the Seed.—Carrots, mangolds or sugar-beets should be sown as early in the spring as the ground is in working order, and warm enough to insure the speedy germination of the seeds. Though a fair crop is sometimes raised when the sowing is delayed till June, yet I have had the best success when sown early.

Carrots require two pounds per acre, beets and mangolds four, and rutabagas one pound.

Carrots should be sown in rows fifteen to twenty-four inches apart and be thinned out to three or four inches for the larger kinds.

A favorite plan with me is to ridge the land with a one horse plow, furrows three feet apart. Rake the ridges lengthwise, so that all obstructions to the drill will fall each way into the furrows, leaving the beds slightly elevated and about twenty inches wide. On these sow two drills about one foot apart. In culture use the horse hoe in broad spaces, and as the beds are slightly raised, the carrots will be less likely to be covered than where the surface is level.

Carrot seed is naturally covered with hooks which prevent its even delivery by the drill, except they are removed by rubbing carefully with the hands.

Hoe them out as quick as the rows can be seen; do not wait for the weeds to get a start, and cultivate and hoe often till the tops cover the ground. In a favorable season with proper care they will grow right along till there is danger of the ground freezing, when they should be dug. They should be dug earlier if they are blighted or from any cause lose their leaves and cease growth.

Carrots may be dug with a spade or fork, or they may be so loosened by running a subsoil plow close to the rows, that they can be pulled by hand.

The White Belgian and the Altringham grow large, and stand with their crowns so far above the surface that they can

be grasped by the hand, but they are more brittle than most other varieties. They are more liable to injury from premature frost than those varieties which grow buried in the soil. The Improved Long Orange is a large, rich, hardy variety, but grows so deep it is difficult to thin out and requires extra labor in digging. For table use, in garden culture, the Early Short Horn is always to be preferred, excelling all other varieties in delicacy of flesh and flavor. Carrots may be buried in pits or stored in a cool cellar, but kept from severe frost. For table use cover with dry sand to prevent shrivelling or place in barrels and cover with potatoes.

Feeding Carrots.—I think I have found more benefit from carrots when fed to horses than to other animals. For calves and milch cows they are first rate; swine eat them freely, and indeed there is no other root so generally relished and eaten without education by all animals as the carrot.

With proper manuring they may be grown successfully for many years on the same field, and we have known this practice adopted with advantage on farms where rotation was not convenient. Clear off the rocks, drain if necessary, and subsoil, keep out the seeds of weeds, and fine crops can be raised even on our stubborn hills. Five hundred bushels per acre is a good crop, but one thousand can be raised with care upon good soil.

We have advised to sow mangolds and sugar-beets early, but some say that the young plants are liable to be killed by frost. The self sown beets that spring up in the garden where seed has been raised never seem to suffer in this way by moderate frost, and we have never had a crop injured by frost. Plant carrots and ruta-bagas shallow, from one half inch to one inch deep, according to the character of the soil; beets and mangolds deeper, from one to three inches.

Mangolds and sugar beets require a space of twenty-four to thirty inches between the rows and ten to fifteen inches in the row. They come up somewhat irregularly from the drill as the capsules are of unequal size, and some of them contain several seeds. An instrument like a large rake head with teeth at proper distances may be used for making the holes,

and the seed may be dropped and covered by hand. The young plants bear transplanting well and vacancies may thus be filled, and the proper thinning out should be finished as soon as the plants are large enough to escape the cut worm.

Beets and mangolds should be gathered before severe frosts; a temperature of 25° safely borne by the deep growing carrots and the ruta-bagas will often blacken their crowns and cause decay. Also the growth will be checked and if allowed to stand and warm growing weather succeeds, the roots emit new fibres, as when replanted in the spring, the sugar is transformed into other substances, and the feeding value is diminished. We have often noticed this failure in sweetness in the table beet when left too late in the ground.

Stored in a cool cellar or pit beets keep well, in fact they are considered to improve in quality till past midwinter. In harvesting avoid breaking or bruising as much as possible.

Ruta-bagas should be sown about June 20th in drills two feet apart, and thinned to one foot in the row. In very rich soil they need even more room than this. The first thinning may be done with the hoe, striking through the rows, but singling must be done by hand. This should be done early before the plants become weak from crowding, and the vacancies, if large, may be filled by transplanting, but we should not fill up spaces of less than two feet in the row.

If growing well allow them to stand in the field till danger that they will be frozen in, for they increase rapidly in size in the cool weather of autumn.

In harvesting trim off the tap root as it is woody and strong flavored, and its presence holds dirt and favors sprouting. Carefully prevent any leaves from going to the pits or cellar, for in decay they emit vile odors, and if fed to milch cows these and the strong tap roots are the chief cause of the bad flavor sometimes given to the milk.

Good ventilation must be provided for the pits or cellars used for storing. When raised in large quantities they are most conveniently saved in pits. Select a dry place and dig a trench four feet wide and of any desired length, and six inches deep. Pile the roots as high as possible and cover

with straw and six inches of earth. Secure ventilation by bunches of straw forming chimneys three inches in diameter. Before winter add more earth, according to location, so as to secure from hard freezing, but especially from repeated freezings and thawings. These pits may be opened at the end anytime in mild weather when the roots are wanted for feeding and closed with a bundle of straw.

Conveniences for storing and feeding are of the first importance. Often stored in the house cellar and backed a dozen rods or more to the barn and fed on the ground in mud and snow, it is no wonder that root culture is often condemned as unprofitable. It is quite another thing when there is a convenient barn cellar for storage where they can be dumped by the cart load and carried only a few feet to the cattle mangers to secure both the comfort and thrift of the stock.

In feeding to milch cows feed moderately and regularly after milking, salt daily, avoid decayed roots or leaves, and there will be no bad odor or taste in the milk.

Ruta-bagas are sometimes troubled with lice on the leaves and clump foot or bunches on the roots. For the first sprinkle with plaster, ashes or any fine dust. Clump foot more often occurs upon old land and is sometimes attributed to the use of hog manure. Avoid this manure and plant upon new land.

White field turnips are sown broadcast from the middle of July till August and often produce large crops. As milk producers they are not considered as inferior to other roots as far as quantity is concerned. They doubtless much improve a diet of dry hay and straw, but their low value hardly warrants the labor of gathering, topping and storing. They will not injure the flavor of the milk if properly fed from the field, tops and all, and in October the quality is usually very rich so that we may get good milk even feeding with white turnips.

The relative merits and advantages of the different kinds of roots are worthy of brief discussion. Carrots usually require the most labor in culture and harvesting, but they keep well, improve the quality of the milk and beef, and are relished by all kinds of animals.

Beets and mangolds sometimes yield very large crops, from thirty to forty tons per acre, but with me the produce has been irregular without satisfactory reasons. In all root crops the *variety* of the seed has much to do with the result. It should also be fresh and well matured. Lane's Improved Sugar Beet promises to be a success. For feeding swine and milch cows beets and mangolds are highly esteemed, and those few cases when the returns have been unsatisfactory in milk I refer to their second growth, changing the substance of the root. Examinations made for sugar making show that their quality varies much with the soil, season and fertilizers.

Rutabagas give longer time for preparing the soil and a shorter period of culture, delight in fresh manure, and the average yield is as great or greater than that of mangolds. All animals do not eat them as readily as the two preceding, but may be taught. Swine will even eat white turnips if forced to it by starvation, but this is not a profitable use of this root. It will depend upon the soil, the season, the quality of the manure and the uses of the crop, which kind of root may be most desirable to raise. If the soil and manure clearly indicate some one kind I should plant only that kind, but otherwise would raise carrots, beets and rutabagas, as the season unfavorable to one might be most favorable to another. Again, the labor of culture will be better distributed through the season and the period of harvesting be more protracted so that the tops can be fed to better advantage.

I have purposely omitted any reference to analysis as showing the particular composition of the various root crops. They contain about 80 per cent. of water with variable proportions of nutritious matter. The variety of each root, the soil, the season, the age of the plant or time of harvesting, and the fertilizers used, so largely influence their quality that an analysis of one sample or even of several could hardly be relied upon to represent the value of any one of the root crops. Feeding is the great test, and good judgment must here be exercised. Fed in connection with hay, straw or grain they always give great satisfaction. When used as the principal

food, especially in extreme cold weather, there has been disappointment. A cow will eat over a hundred bushels of white turnips in a month, and suffer from such a watery diet, while a half bushel per day added to a moderate allowance of hay largely improves the health and thrift of the animal.

To recapitulate the fundamental conditions for successful root culture: we must have good seed, a fertile, well prepared soil, free from the seeds of noxious weeds, seasonable culture and thinning, that the young plants be not choked or drawn up weak from weeds or crowding, neat and timely harvesting and storing, followed by careful feeding. These conditions being secured, root culture gives both satisfaction and profit.

REPORT OF THE VETERINARY SURGEON.

In compliance with the duties assigned me, with instructions to inquire into the prevalence, nature, and causes of the contagious diseases among our domestic animals, I would respectfully submit the following report for your consideration.

The past year has been an important one in the veterinary annals of our state. And though we have not been visited by a return of the "Foot and Mouth Disease," as was feared, yet in the mean time there have appeared within our borders two other equally contagious disorders which have already caused no inconsiderable loss of live-stock property, and whose latent germs, I fear, have only been too widely sown; and from the many exposures, which had undoubtedly occurred ere the disease was investigated, further difficulties must inevitably ensue during the present season, unless retrenchment is enforced.

The first of these epizoötic maladies to which my attention was officially called, was the occurrence of

FARCY AND GLANDERS

at Bridgeport. I visited the place, Oct. 3d, at the request of Secretary Gold, and found, upon careful inquiry, that the disease first broke out in McCoy's stable, some time in July; but it was not considered dangerous by the attending farrier, nor worthy of any alarm, until after several horses had died, and even then they were loth to admit that it was in any degree contagious. Thus, in the course of three months, quite a number of exposures had occurred, and some of them showed characteristic symptoms of this disease. Three of these horses, which were supposed to have recovered from their "complaint," so called, I found in pasture, out at Iranistan, on Barnum's old place.

There was a chestnut horse suffering severely from glanders, and also a black mare with both farcy and glanders, belonging to Richard McCoy. The third was a bay mare, belonging to G. P. Stockwell, with quite a number of characteristic farcy buds on the left hind leg. This horse had been boarded for some time in McCoy's stable.

These creatures were all very poor and showed little or no signs, in my estimation, of ever being restored to health or usefulness again, even though it be proved that their disease was not malignant. And as all pretended that the horses were improving, I gave them the benefit of the doubt, and thus quarantined the animals and demanded better care; but as there was so much excitement about the matter, I requested Mr. Gold to meet me there Oct. 10th, and he accordingly did so. We found the black mare and Mr. Stockwell's in about the same condition, but the chestnut horse was much worse, as the *acute* form of this disease had set in, and must inevitably prove fatal in a few days. The animal died the 15th from this disease.

We visited the yard again the 18th, and thought that the other two showed some signs of improvement, from having had more suitable care and attention. Others believed that these two horses would ultimately recover. And so, in order to satisfy those doubting minds, we proposed to demonstrate the nature of the disease in question, by a test experiment of inoculation. Accordingly we purchased a cheap, but healthy horse, though maimed by an injury on the knee-joint, and inoculated him in the hip with the matter from one of those farcy buds on Stockwell's mare. E. B. Middlebrook, M. D., a practical veterinarian of that city, assisted us in the operation, and kept a watchful eye upon the result.

I visited the patient again the 31st, and found that the wound which we had made had not healed, but was discharging profusely. The matter looked very unhealthy, and there were some symptons of constitutional difficulty. In the course of ten days *acute glanders* set in, and the horse died Nov. 17th from the effects of the engrafted disease, as we anticipated.

Dr. Middlebrook made the *post mortem* examination, and

wrote me that "the mucous membrane of the nose and upper part of the wind pipe was very much inflamed, and copiously bathed in a limpid yellowish secretion. There was some ulceration upon the nasal cartilage, and incipient tubercles in the lungs."

Such should have been the appearance of a typical case of glanders in the *acute* form, but as I was not present at the examination, and being a *positivist* in my pathological researches, I can not speak from eye witness authority concerning these morbid changes and the termination of this experimental case, yet I was satisfied, in my own mind, as to the result, even though others were still doubting.

In the course of a few months, Stockwell's mare and the black one having died, as I had predicted, I was determined to watch the result of these exposures, and if another case occurred, to call to our aid the best veterinary authority in this country. And my expectations were soon fulfilled, on receiving a letter from Dr. Middlebrook, April 11th, saying that a valuable horse, belonging to the Adams' Express Company, showed unmistakable evidence of having contracted the same disease by having been boarded in Gates' stable, which is in close connection with McCoy's, on Middle street.

I visited the case April 16th, and found that this disease had really broken out again in a very aggravated form, and so I informed Mr. Gold of the fact, and he at once notified Prof. Alfred Large, of the New York College of Veterinary Surgeons, to meet me there in council, and he accordingly did so on the evening of the 26th of April; and, after a very careful examination, the Professor pronounced it to be a "confirmed and malignant case of glanders," and recommended the "leaden ball" as the only means of cure. Such a statement from the learned Doctor was very satisfactory, as it fully corroborated our course of investigation.

Several other horses died during the winter, by having been exposed in that stable. Dr. C. E. Sanford had a very spirited carriage horse that was taken sick while boarding there; and though the Doctor gave it the best of attention, with kind and humane care, in hope of cure, yet without success.

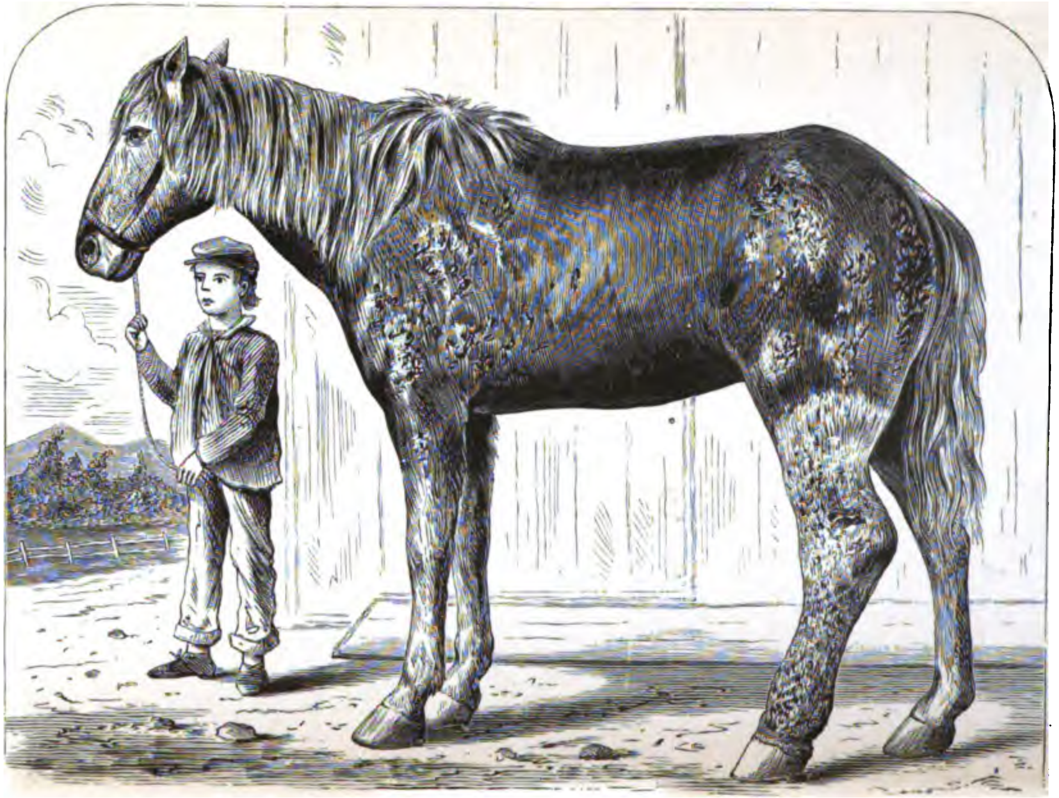
James W. Embury also lost one in a similar manner. McCoy has also lost several other horses, and, unless great pains have been taken to cleanse, and purify those stables, he will undoubtedly find more trouble near at hand. The best of treatment have availed them nothing.

Some time in the fall this disease also made its appearance in Waterbury, and caused the death of quite a number of horses before any notice was taken of the matter. When I was called there, Feb. 21st, I found several more very sick, and I ordered two of them to be shot, in order to prevent the further spread of the contagion. One of these, which I had photographed, as seen in the accompanying engraving, belonged to Horace Wooster, who had also lost a fine pair of work horses from this same disease a few months previous.

S. M. Judd had also lost a draft-horse late in the fall, and had a fine carriage horse in the same stable; and though we could not discover any characteristic symptoms of either farcy or glanders, yet there was a glandular swelling upon the under side of the throat which looked very suspicious. And so we concluded to keep the horse quarantined for a few weeks, and give him the benefit of a thorough course of *alterative* medication, in view of testing the malignancy of this supposed infection. Dr. Middlebrook was present and put in a *rowel*, which, with the medicines, had a good effect, so that he is now apparently well, and I trust will never show any further constitutional symptons of this disease.

The other horse, that I ordered shot, was glandered, and belonged to C. N. Hall, who had lost one previously, of glanders, and who had several other valuable horses upon the same premises; and, though we feared the result of this local contagion, yet we have seen no new development of this affection in that stable. Michael Collins also lost a valuable work-horse from glanders some time in the winter.

This disease has also occurred at Meriden, and quite a number of horses have died, as I have been informed; but I was not called there in time to investigate the matter, and therefore cannot speak, as I would like to, from positive knowledge. Yet, from the symptoms, as related, I think there can be but little doubt as to the nature of the malady.



CHRONIC FARCY.

Thus you see that the ravages of this *Equine Plague* have not been confined to Bridgeport. It has occurred with equal severity in other places. In fact, it has been a scourge upon our land for many years, and thousands of valuable horses have fallen victims. From accurate statistics which I have thus been able to collect, I am authorized in saying that upwards of *five thousand* dollars' worth of live-stock property have been needlessly sacrificed, within this state, in the last nine months, by the *increased* propagation of this contagious malady. And still, farmers and livery men are unconcerned, and thus wantonly traffic in such worthless and dangerous property from year to year.

This disease always originates in the equine family, and in its courses of development presents several interesting phases for the inspection of the pathologist.

In former times, it was supposed that farcy and glanders were two separate diseases, and had no connection with each other. But, by the recent advances in veterinary pathology, it has been conclusively proved that they are only the different manifestations of one and the same disease. Both are generated from one identical *virus*, either in the acute or chronic forms. And this same *virus*, when inoculated into the blood of man, develops a similar form of disease, which is known, from its source, as *Equina*, and is generally fatal. And even the malignancy of this *virus* is not destroyed by thus becoming humanized; for, if we inoculate a healthy horse with the matter from one of these *farcied ulcers* on man, the original disease reappears with all its contagious and malignant characters. Thus it behooves us to be on our guard when in attendance upon all such veterinary patients. Undoubtedly many poor hostlers have died from a so-called "scrofulous affection" which originated in the stable of a glandered horse, and was transmitted to them by inoculation while grooming. For, to become thus infected, it would only be necessary for the virus to come in contact with the mucous membrane of the eye and nose, or upon any broken surface of the skin.

Of the four well marked forms of this disease in the horse,

Chronic Glanders is by far the most common. Its period of incubation is uncertain, and may vary from a few days to even a year. At first, the general health is but little affected: there is swelling of the lymphatic glands under the jaw, and they become more or less hardened as the disease progresses. A discharge occurs from one or both nostrils, which is at first of a watery consistency, then becomes gluey, purulent, and fœtid. Ulcerations occur on the mucous membrane of the nose. A horse, even with such symptoms, may otherwise appear to be in perfect health. But when placed under unfavorable circumstances, especially when worked hard and fed scantily, symptoms of Acute Glanders appear, and then death soon follows. This form of the disease sets in suddenly, with symptoms of inflammatory fever; tho respiration becomes hurried, and there is a copious yellow and purulent discharge from the nose, and a watering from the eyes, which indicates the severity of the inflammation, and the certainty of approaching death, in the next ten days.

Chronic Farcy usually commences by an indolent inflammation of the lymphatic vessels and glands, which eventually become red and tender. These glandular swellings chiefly occur in the situation of the lymphatic valves, and are known as *farcy-buds*. There is usually a well marked eruption on the skin, with more or less sub-cutaneous or deep seated tumors, which soon break, and thus secrete a foul and ichorous discharge for many days, unless *acute* Farcy sets in, when death inevitably follows.

The *acute* forms of this disease are distinguished from the *chronic* by the rapidity of their course, and the urgency of the constitutional symptoms. Thus we have seen that these four forms of this contagious malady are intimately associated with each other. In fact, death seldom or never occurs in the chronic forms; an acute attack often follows which speedily results in death. There is no hope in such a case, when the symptoms are well marked.

This is certainly one of the most loathsome diseases in the whole catalogue of contagious affections. And may it not yet be demonstrated, in the rapid strides of comparative pathology, that it belongs to the class of *specific fevers?*

In relation to treatment, there is little to be said. Various systems of medication have been faithfully tried, but to *no* effect; its progress marches steadily on in spite of every mineral and herb that the land affords, or at present known.

In the chronic forms, where the greatest constitutional prostration occurs, stimulants are surely indicated, but their effects are very transient. Arsenic and strychnine have been recommended as very efficacious in the treatment of the local affection; and I would suggest the *free* use, externally, of carbolic acid for the same purpose. Thus, when every medicinal remedy has been tried, the *mortal canker* of this equine plague may still exist, then the pole-axe or the leaden ball is, of course, our last resort. Such *should* be the treatment of every well marked case of this disease.

And though we cannot cure such afflicted horses, yet we can, by judicious management, prevent others from being exposed to this contagion in one of these infected stables. When a barn has thus become contaminated, no creature of the *equine* family should be placed within its tainted walls until it has been thoroughly renovated. The floor of the stall, as well as the crib, and the partitions, if old and considerably worn, should be replaced; but if the material is comparatively new it may be overhauled and planed, and thus rendered harmless. Where an iron crib is used, or any metallic implement employed about such a horse, it should be carefully cleansed with a weak solution of mineral acid. A strong solution of potash should be effectually applied to the hitching posts, beams, and other places where such a horse has been recently tied; and the whole stable whitewashed. The free use of carbolic acid, chloride of lime, and other disinfectants, is of great importance in such a stable.

Another contagious malady, no less malignant, and one of far more importance to the health of the community, has made its appearance upon the western borders of our state, and is scientifically known, from the organs which it attacks, as

PLEUROPNEUMONIA,

or a disease of the lungs and their surrounding membranes, and

thorax. We have a similar *form* of disease in the human system, though not contagious; and there is *no* connection between the human and the bovine forms of these lung difficulties. The disease in man is an inflammation of those organs, while the one in question is a *specific* and *contagious fever*. It is in fact a "blood disease," so called, and the inflammatory symptoms are only *secondary*; for the disease may run such an insidious course that there will not appear any very perceptible phenomena connected with those vital organs. And when a creature has once passed through even a mild form of this disease, it is ever afterward exempt from such an attack, the same as with measles and scarlet fever. And it has been found by experiment that we may inoculate this disease, and thus get a mild or *varioloid* form, which also exempts the creature the same as vaccination does from small-pox. But such inoculations have not always been attended with satisfactory results, inasmuch as it is often difficult to obtain suitable lymph from the lung at the right stage of the disease, free from *pus* or other morbific matter. And unless great caution is taken in thus inoculating a given herd, the disease may even spread by such experimentatives, and also prove occasionally fatal, so we should be on our guard when attempting to retrench this disease by inoculation. Yet with care, valuable results may be obtained, and thus the herds in any locality may enjoy a perfect immunity from this dire calamity.

This method of inoculation is extensively practiced in the swill-milk stables of Brooklyn, L. I., and its effects have given rise to the "Stumptail Cattle Disease," so called. Epizoötic pleuropneumonia is comparatively a new disease in the United States, and though its ravages have been felt for centuries upon the continent of Europe, yet it is within the last thirty years that this lung plague has appeared upon our virgin soil. The first case occurred in the Brooklyn cattle sheds in 1843, from direct importation, and it has been lurking about the stables in that vicinity with more or less severity ever since.

In 1847, Thomas Richardson, of New Jersey, imported some English stock, which brought the disease over here

again; and to prevent its spreading he was obliged to slaughter his entire herd, which cost him nearly $10,000. W. W. Chenery, of Belmont, Mass., had four cows shipped from Rotterdam in 1859, but before they had reached our shore two of them sickened and subsequently died, as did the third one also a few weeks afterward. From this fourth cow the the disease spread rapidly in that state, and thus cost the Commonwealth in public and private munificence more than $30,000 to retrench its ravages in 1860. It broke out again the following year with increased severity, and continued to spread until it involved some fifteen towns. The disease was finally exterminated in 1867, but with heavy expenditure to the State; and hence, from its extensive prevalence in that state, it is often referred to as the "Massachusetts Cattle Disease." It has also, in the meantime, occurred in several other states. Now it has invaded our borders, and threatens to extend beyond its present limits unless quarantine regulations are strictly enforced, and the *cordon* be tightly drawn upon our western boundary line, and *perhaps* the pole-axe vigorously swung at the public expense before the season is over.

My attention was first called to the present outbreak of this disease, in Ridgefield, by a dispatch from Secretary Gold, requesting me to meet him there to investigate the matter. On our arrival, March 11th, we found that Henry A. Stuart had lost three valuable cows, and had another very sick with this same disease. He had separated the sick cow from the rest of his herd, as there was no hope of her recovery, and as he feared that the disease might be contagious. There were six other cows and a pair of oxen in his herd, all of which showed suspicious symptoms of this complaint, the same as those which had died when first taken, though none of them were very sick, yet we quarantined the animals.

I tested the temperature of the body, in the rectum, with Casella's self-registering thermometer, and found that the six cows and oxen manifested those incipient but characteristic symptoms of pleuropneumonia, which nothing but this instrument can detect at such an early stage of this disease. The temperature of the whole herd stood as follows:

No. 1,	102.2
No. 2,	101.3
No. 3,	101.2
No. 4,	102.1
No. 5,	102
No. 6,	101.1
No. 7,	105.1
Near ox,	102
Off ox,	100

The normal temperature of horned cattle is usually about 100, though it will vary slightly under different circumstances. Thus it will be seen that all were more or less affected, and that the sick cow, No. 7, had an increased temperature of nearly six degrees, which, with the other symptoms, indicated the certainty of approaching death. And though the cow afterward showed some signs of improvement, yet she finally fell a victim to this disease, April 26th, when I found, on post mortem examination, the right lung virtually consumed.

Symptoms:—Cattle with this disease usually maintain the standing posture, unless in extreme and urgent cases where exhaustion compels them to lie down. They stand motionless with the elbows or shoulders turned out as far as possible, arched back, and protruding head. The hind limbs are usually drawn under them, with slight knuckling of the fetlocks. When lying, in the last stages of the disease, they rest on the brisket so as not to encumber the free action of the lungs. Their breathing is labored: and there is a slight hacking cough, often attended with a characteristic grunt and grinding of the teeth.

These symptoms were all very apparent in No. 7, but the other cases manifested only a slight disturbance of the general health, and none of them have grown any worse, yet the temperature in the oxen remains the same. And there are several other creatures in that vicinity which are *suspicious* when tested by the thermometer.

The origin of the disease is veiled in more or less obscurity. We are not able, as yet, to trace this malady with that degree

of eaxctness which the emergency of the hour demands, in view of its progress and the many exposures that have undoubtedly occurred. But since it came under our inspection, enough has come to light to assure us of its contagious nature, and *probable* source of infection.

It appears that this disease has been lurking about in Westchester county, N. Y., for several years, and that Stuart bought two cows at North Salem, N. Y., some time last fall, from A. B. Mead. These cows were undoubtedly affected with the disease in a latent form, as indicated by the thermometric test. Nicholas Van Wart, of New Rochelle, N. Y., bought a pair of oxen of Mead, in January, which had recently come from Stuart's farm. One of the oxen was taken sick in February, and soon died. In a few weeks, Van Wart noticed that a heifer, which had been with these oxen, was sick with this same disease and died April 11th. Stuart's cattle were taken sick about the same time that this ox was, thus indicating that the disease in both cases had a common origin, and probably from those cows which Stuart bought of Mead last fall.

Yet there is strong evidence that the disease has been in Ridgefield for several years. Wesley Slawson lost a cow about a year ago with symptoms, during life and at death, *very* similar to all these other fatal cases. And in fact there have quite a number of cattle died in that town within a few years past very *mysteriously*.

The indications for medical treatment will of course vary according to the advancement of the disease, and the general conditions of the patient. In the early stages of this malady, where we get an increased temperature of two or three degrees, with an accelerated pulse and a quickened respiration, depletion and other arterial sedatives are always indicated, and will play an important part in the successful treatment of this affection. But in more aggravated cases, when the respiration becomes hurried, and the vital powers begin to lag, tonics and generally stimulants should be freely given, in order to keep up the strength until Nature may, possibly, effect a resolution. And yet, many times when every indica-

tion has *seemingly* been fulfilled, in accordance with the best authority on veterinary therapuetics, the progress of the disease remains unchecked, until death soon follows in its natural course, from excessive effusion.

The special remedies which a given case requires can only be determined by the daily inspection of the veterinarian, when at the stall of the afflicted animal. And this disease, like its allied form in the human system, requires early and energetic treatment, as the mortality *may* be very great.

Whenever a case occurs, or a creature shows suspicious symptoms of this disease, it should be removed at once from the rest of the herd, and due notice given to some member of the Board in accordance with the *law*, and also in that neighborhood that the other stock may be shielded from its contagious influence. And when the creature recovers, or has died, the place of its abode should be thoroughly cleansed in a similar manner as I had already pointed out. And the farmer should be very cautious about exposing other stock in such infected stables.

HORSE DISEASE AT NEW HAVEN.

At the call of Secretary Gold, I met him at New Haven, May 19th, to examine a Horse Disease that had broken out in the stables of the Fair Haven & Westville Horse Railroad Company. We found that twenty-four horses had been sick, two of which have died; the others are slowly improving. The malady appears to be that known as "the New York Horse Disease," or, in scientific language, "cerebro-spinal meningitis." By the best authorities, it is not considered as contagious, but rather as epidemic. These horses were all taken sick about the same time, and all except the first two cases promise to recover under proper medical treatment. Some other cases are reported as having occurred in other stables, but no connection can be traced between them.

N. CRESSY.

Hon. T. S. Gold,
Sec. Board of Agriculture.

FOOT AND MOUTH DISEASE.

By the Secretary.

A brief report on the "Foot and Mouth Disease," or Epizoötic Aptha, which visited the state in the winter of 1870–71, is here given.

Attention was first called to this subject by a letter from T. L. Harison, Esq., Secretary of the New York State Agricultural Society, addressed to me as Secretary of the Connecticut State Agricultural Society. Mr. Harison states "that this disease was prevailing extensively in Dutchess Co., N. Y., and had invaded the adjoining towns in Connecticut," and suggested that the proper authorities should take measures to prevent its spread. This letter was immediately transmitted to His Excellency J. E. English, who requested me to investigate the subject and report. I found the facts as stated, and that the disease was communicated by two droves brought on the cars to Poughkeepsie and driven thence across Dutchess County to Kent and New Milford, and that it had appeared in other sections of the state.

Jan. 12th, three commissioners, E. H. Hyde, T. S. Gold, and H. L. Stewart, were appointed by the Governor, "to furnish all needed information to the town authorities in regard to the nature and treatment of the disease and preventing its further progress in the State."

The Commissioners immediately issued a circular to the town authorities, describing the disease and giving warning of its exceedingly contagious nature. We found on examination that the disease was very likely to break out in cattle coming through the cattle yards at Albany, indicating that as the infected point whence the contagion emanated. While in the western and central parts of the state it came directly from Albany and the cattle cars, in the eastern part it was directly traced to Brighton Market. Its short period of incubation, (time from exposure to breaking out) from four to six days, gave especial facilities for tracing its origin and progress, and left no doubt of its being a specific disease of an exceedingly contagious character. Besides those animals which went to

the slaughter, of which we have no knowledge except after the fact, the disease has prevailed in the following towns: New Milford, 44 cases; Kent, 60; Sherman, over 100; Warren, 17; Bridgewater, over 100; Roxbury, 23; Southbury, 4; Norwalk, 42; Darien, 20; Stamford, 6; Greenwich, 10; Meriden, 9; East Windsor, 26; Hartford, 28; North Haven, 20; Vernon, 30; East Berlin, 30; Canterbury, 26; Cromwell, 15; Rocky Hill, 30; Woodstock, 3; Thompson, 100; also cases in West Hartford, Windsor, Bristol, New Britain and some other towns.

Sheep and swine also suffer with the disease, and several cases occurred in both these classes of animals.

The Cattle Commissioners of New York, Massachusetts, Maine, Rhode Island, and Connecticut met in Albany, Feb. 9th. The history, character, and means of suppressing the disease were thoroughly discussed.

The "Foot and Mouth Disease" is by no means a new thing, but has been long known and described as existing on the European continent. Its introduction into Britain, however, dates back only about thirty years. Within this time it has repeatedly overrun the whole kingdom, with the exception of some isolated districts devoted strictly to breeding cattle and away from the lines of cattle traffic.

The disease was imported from England into Canada in August, 1870, and came thence to Oneida County, N. Y. In November and December it appeared extensively in Eastern New York, Massachusetts, Rhode Island, and Connecticut, as emanating from the cattle yards at Albany.

This malady, with the Rinderpest and Pleuropneumonia, have sorely afflicted the farmers of Britain, so that it is estimated that their annual losses of neat stock for the last ten years from these contagious diseases have averaged the enormous sum of £10,000,000 sterling.

Animals seldom die with the "Foot and Mouth Disease." The sickness usually lasts from three days to three weeks. The damage consists in the loss of labor, of milk, and of flesh, and is variously estimated in different herds as ranging from ten to twenty-five per cent. of their value. Of course

individual cases exceed these limits. Our herds in this state are mostly small, yet some of our cattle owners estimate the damage they have sustained at from $500 to $1,000.

The losses to the farmers of Dutchess County from this disease, from careful examination by the sub-commissioner in charge, Dr. D. Guernsey, are estimated at $40,000.

As soon as the nature of the malady became known active measures were taken by the authorities to prevent its spread, by a thorough system of quarantine and the disinfection of the yards and cars occupied by the infected cattle. The disease, though still prevailing with severity in England, appears most happily to be exterminated in America.

The symptoms are so well marked as not to be mistaken. The animal refuses food from the soreness of the mouth. The half chewed cud is rejected. There is a peculiar smacking of the lips; profuse flow of clear, frothy saliva. Blisters appear on the nose, mouth, and tongue. The tongue is swollen and in severe cases protrudes from the mouth. The teats become puffy and hard, with blisters on them. The milk diminishes or fails entirely. The bowels are constipated. There is a high fever with occasional shivering. Watery blisters appear about the heels, which afterwards exude viscid and fœtid matter. The fore feet are often affected between the toes. The animal in walking shakes the feet as if desirous to get rid of some foreign substance. There is a general soreness or lameness of the whole body. Later in the progress of the disease the skin of the mouth, tongue, nose, and teats hangs in loose shreds and drops off, as also the scales from the affected heels. Cleanliness and dryness are favorable to recovery, which is speedy when there are no adverse circumstances. Active treatment is not recommended. As soon as the crisis of the disease is past, recovery will be hastened by applying any remedies of a cleansing and healing nature. Washing the sore heels with carbolic soapsuds, or with a weak solution of carbolic acid is beneficial.

The flesh was used, for food, of many diseased animals, with no observed ill effects, before the dealers were aware of the presence of the disease. The milk should never be employ-

ed for food, as several cases are reported where children and others suffered from its use, and analysis shows that its important constituents are changed.

It is hoped that, once rid of the pest, America may enjoy future exemption from it, for, though rarely fatal, it is a very troublesome malady.

ADDITIONAL OBSERVATIONS ON THE PARASITES OF MAN AND DOMESTIC ANIMALS.

BY A. E. VERRILL.

In the following pages some species of parasites are added to those enumerated in the last report, as found in the domestic animals. Many additional facts have also been ascertained concerning the habits and history of several of the species previously described, and some of the more important of these discoveries will be noticed here.

INTERNAL PARASITES OF MAN.

The name of the following species in the list, (Report for 1870, p. 170,) should be changed to the earlier one given by Diesing. *Bilharzia hæmatobia* Cobbold, 1864, should be *Gynæcophorus hæmatobius* Diesing, 1858.*

INTERNAL PARASITES OF CATTLE.

Ascaris lumbricoides Linn. Small intestine. This species, which was accidentally omitted from the list (page 176) of the last report, but mentioned on page 235, should be added. It is regarded as perfectly identical with the common "roundworm" of man.

INTERNAL PARASITES OF THE HORSE.

The following species should be added to the list, (p. 177.)

Onchocerca reticulata Diesing. A small nematode worm, resembling *Trichina*, found in the muscles and tunics of the arteries.

Pentastoma Settenii Diesing. Found in the eye.

INTERNAL PARASITES OF THE HOG.

The names of the two following species should be changed.

Strongylus dentatus should be *Sclerostomum dentatum* Rud.

Sclerostomum pinguicola should be *Stephanurus dentatus* Diesing.

* Revision der Myzhelminthen; Trematoden: Sitz. Akad. der Wissenschaften, 1858, p. 356.

Internal Parasites of Poultry.

The following species should be added to the list on page 179, Report for 1870.

CESTODES.

Tænia megalops Nitzsch. Intestine of ducks.
T. gracilis Rud. " " "
T. trilineata Batsch. " " "
T. coronula Dujardin. " " "

T. echinococcus? A species allied to or identical with the common *echinococcus* has been found in the encysted state in the lungs of the turkey.

TREMATODES.

Monostomum attenuatum Rud. Intestines and cæcum of geese.
Distoma cuneatum Rud. In the oviduct of a pea-hen.
D. echiniferum La Val. Intestines of ducks, pigeons, &c.
D. armatum Molin. Intestines and cæcum of hens.

NEMATODES.

Ascaris gibbosa Rud. Intestines of hens.
A. dispar Schrank. Intestines of geese.
A. vesicularis Frölich. Large intestines and cæcum of hens, peacock, and turkey.
Filaria anatis Rud. Heart of ducks.
Spiroptera nasuta Rud. Crop of hens.
S. tricolor Diesing. Tubercles in crop of ducks.
Tricosomum brevicolle Rud. Intestines and cæcum of geese and ducks.
T. longicolle Rud. Large intestine and cæcum of hens, geese, &c.
T. tenuissimum Dies. Large intestine of pigeons.
Eustrongylus tubifex. Œsophagus and crop, often in tubercles, in ducks and various other aquatic birds.

Of those previously enumerated as found in ducks and geese, the following have also been found in hens: *Tænia malleus* Goeze, *Notocotyle triserialis* Diesing (same as *Monostomum triseriale*), *Distoma ovatum* Rud. *Ascaris inflexa* Rud. is found in the intestines of ducks as well as hens.

The Broad Tape-worm of Man, (*Bothriocephalus latus* Bremser.) Report for 1870, p. 212.

It has been ascertained by Dr. Koch that this species lives while in the young or larval state in running streams, attached to stones, instead of being parasitic in some fish, as had been previously supposed. Therefore we may expect that it will, sooner or later, be introduced into the streams of our own country, in regions settled by emigrants from those parts of Europe infested by it; for the mature worm has often been found in such emigrants in various parts of the United States.

Echinorhynchus gigas Goeze, (See Report for 1870, p. 220.)

This common intestinal worm of the hog, has attracted much attention recently, on account of its remarkable structure and mode of growth.

It has been ascertained by Mr. E. G. Balbiani,* that although the development of the eggs commences before they are laid, it soon ceases and can proceed only after the eggs are discharged and fall to the moist earth or water; that several months elapse in winter before the embryos hatch, and the hatching may be delayed a year without destroying the vitality of the embryo; and that the eggs will not hatch in the intestine of the animal in which the adult worm resides, but pass into the body of some other animal, where the embryo passes through its first stages of growth.

Professor A. Schneider† has traced its development and history quite satisfactorily. According to his observations the history is as follows: The ova of this worm are scattered upon the ground by the pigs harboring the adult worms in their intestines. They are then devoured by the larvæ of the cockchafer beetle, (*Melolontha vulgaris*, allied to our "May-bugs,") in which they develop. The ova burst in the

* Comptes-rendus, Vol. lxix, p. 1091, 1869.

† Sitzungsbericht der Oberhessischen Gesellschaft für Natur- und Heilkunde, March, 1871. Also, translated in the Annals and Magazine of Natural History, Vol. 7, p. 441. 1871.

stomachs of the beetle-larvæ, and the embryos thus liberated penetrate by means of their boring spines through the intestines into the body cavity of the larvæ; here they become more developed, and finally reach the intestines of the pigs when the latter devour the beetle-larvæ containing them, and there grow to maturity. When the embryos have arrived in the body cavity of the larvæ of *Melolontha*, they remain for some days unaltered and capable of motion; they then become rigid, acquire an oval form, and envelope themselves in a finely cellular cyst, which is formed of the connective tissue of the larva. The skin of the embryo, with its circlet of spines at the anterior end, continues at first to be the skin of the growing larva, and it is only at a later period, when the formation of the hooks commences, that it is thrown off, when it forms a second cystic envelope.

The beetle-larvæ infested with the young *Echinorhynchi* live on until their metamorphosis into cockchafers. As the thorax of the cockchafer is sometimes eaten by man, we can understand that the *Echinorhynchus gigas* may also get into the intestines of man. It has once been found in that situation by Lambl. Professor Schneider also describes the development and metamorphosis of the larva of the *Echinorhynchus*, with reference to its internal organization.

It is probable that in this country the eggs of this parasite hatch in the larvæ of the May-bugs (*Lachnosterna*), and goldsmith-beetles (*Catalpa lanigera*), which are allied to the cockchafer of Europe and have similar habits. These larvæ are large, plump, whitish or yellowish grubs, usually darker posteriorly, and furnished with three pairs of legs. They are always abundant in manure heaps and in the soils of yards and gardens, but are also found in fields and pastures, so that there are abundant opportunities for them to get at the eggs of the *Echinorhynchus*, dropped by the pigs, and for them to be devoured in their turn by the pigs.

The bronchial Strongylus of Horses and Cattle. (*Strongylus micrurus* Mehlis.) See page 240, Report for 1870.

During the past year a serious outbreak of the disease caused by this parasite occurred in Alleghany County, New York, which caused the death of many calves and the serious disease of all the cattle on the farm. Some of the worms were sent to me for examination, by Thomas L. Harison, Esq., secretary of the New York State Agricultural Society. They proved to be identical with this species, long known and dreaded by the farmers of Europe. Professor James Law, who investigated this case, as well as two others of less importance which occurred previously, has published a full and interesting acount of them, in the Journal of the New York State Agricultural Society, for July and August, 1871, from which the following extracts have been made:

"I have been able to find no proof of the existence of this disease among our sheep, and the only evidence of its existence in calves is derived from the particulars of three outbreaks in different parts of New York, and about which I was consulted.

The first of these took place in the autumn of 1869, among the calves of Mr. Wood, Woodville, N. Y., and though one or two had already died, the malady was easily controlled by putting in practice the measures advised in this paper.

The second outbreak, which was only reported to me recently, occurred on the farm of Mr. Sutton, Ovid, Seneca county, N. Y. In this case four yearlings, fed during the previous autumn on a sloping dry orchard, and watered from a stream in a ravine close by, were attacked in March, 1870, while confined to the yards and fed on clover hay, with water from the stream. Two died in from six to ten days after the seizure, a third remained in low condition and perished in July, and the fourth recovered. On this same farm the chickens and turkeys perished last summer in great numbers from *the gapes*, and squirrels have furnished specimens of bronchial

parasites. The third outbreak took place in July last, on the farm of Mr. S. P. Swift, Cuba, Alleghany county, N. Y. Nineteen calves were attacked, eleven of which had died at the time of my visit, and all the cows on the farm coughed and looked badly. The cows with which the malady probably originated, grazed on a partially cleared field, full of stumps and brush, and abounding in springs and marshy places. They were driven home to milk along a road between the fields occupied by the two lots of calves, and could easily interchange courtesies with them over the fences. Seventeen of the calves kept in one field got water from a deep, enclosed well in the centre of the field, while the remaining two never had water but only milk. The calves lived, on an average, from nine to fifteen days after they were attacked. Treatment, as recommended, thoroughly destroyed the adult worms, as I failed to find one in the bronchial ramifications of a calf examined and which had been but twice fumigated, while in those that died before the treatment I had prescribed had been put in practice an abundance of worms were found. The yearlings on the same farm, kept on a separate field and without any means of communication with the cows or calves, escaped the disease.

An incident which occurred while one of Mr. Swift's calves was being skinned, throws some doubt on the fatality being due to the worms alone. A cat which licked some of the blood died on the spot, and before the skin was separated from the body; the body of this calf — the only one skinned—is further said to have appeared much infiltrated with black blood, which points to *bloody murrain—charbon*—as the immediate cause of death in this case at least. A cow, too, had suffered some time previously from an equivocal swelling on the jaw, which burst and discharged an unhealthy sanious liquid.

This complaint is probably much more frequent in calves in this country than has been yet recognized, and with our constant importations of English long-wooled sheep it will be a marvel if we fail to import their pulmonary parasite.

In describing the disease it will be convenient to consider

it under different heads, grouping together those animals which harbor the same species of worm.

Verminous bronchitis in the ox, horse, ass, and mule.—The same parasite attacks one and all of these animals. This is the *Strongylus micurus* of Mehlis, a small, thread-like worm, the male one and a half inches long, the female three inches. The head is rounded, with no constriction or neck, the mouth furnished with three chitinous papillæ, the œsophagus club-shaped, the genital orifice of the *female* situated in the anterior half of the body, and the tail pointed: the male has a caudal pouch with five rays standing well apart. They were noticed by Camper to be viviparous, but this must be qualified by the statement that the female, after becoming imbedded in the lung substance, or after being expelled by coughing, perishes often with its oviducts still full of ova, and these gradually hatch out amidst the decomposing debris of the parent.

Development.—The development of the parasites has to be considered as it takes place *in* and *out* of the body. *Within the body* in the earlier stages of their life—that of ova and embryos—the parasites are found imbedded in the substance of the lung-tissue, mostly toward the margins of the lobules, where they may live for indefinite but often long periods. Baillet killed a lamb thirty-two days after he had administered the embryos of a Strongylus filaria taken from the oviducts of a female worm, and found the parasites rolled up into pellets in minute semivitreous nodules in the posterior part of the lungs, and varying in length from one-third to a line. It is probable, therefore, that these lung-infesting strongyli may live for many months encysted in the pulmonary tissue in this imperfect condition. The appearance of the lung so affected is redder than natural, and its surface feels rough and uneven by reason of the numerous exudations around the embryo worms. These nodules, which were long mistaken for miliary tubercles, vary in size from that of a pin's head to that of a barley corn, while at certain points many will become accumulated so as to cause uniform consolidation of lung-tissue to a considerable extent. They vary, too, in consistency from a simple semifluid mass to a hard calcareous shell. The soft and

semitransparent spherical nodules contain the younger worms, often microscopic, and without sexual development, while the larger and dark colored cysts contain worms of nearly their full size, and furnished with sexual organs. Some of the larger cysts are not spherical, but irregular in outline, and these, on being opened, are found to contain the debris of the parent worm with numerous ova and microscopic embryos, mixed up with an abundance of pus cells, granular masses and granules. At times, more or less of the worms approaching maturity may be seen making their way through the mucous membrane from the pulmonary cysts to the bronchial tubes.

The second stage of their existence, and that in which they are most injurious to their hosts, is that of the sexually mature parasite in the bronchial tubes. They may be found at all points from the throat down the windpipe and through the smallest ramifications of the air tubes, either singly imbedded in the frothy mucous, or in large numbers rolled into pellets, and it may be, completely obstructing the bronchial tubes. The mucous membrane of these tubes is reddened, softened, and inflamed, and the smaller tubes that have harbored the worms for some time are usually dilated much beyond their natural size. Many thousands of these worms often exist in the lungs of a single animal, and as one worm will produce its thousands of eggs, capable of contaminating a large herd, their presence in any particular stock ought not to be lightly passed over.

Colin, who has investigated this subject very thoroughly, says: "The strongyli of the calf remain in the vesicular tumors a much shorter time than those of the sheep. They are encysted and quiescent but for a short period and spend most of their life in the bronchia, where they accumulate in masses which intercept the passage of air through many of these tubes and produce an intense dyspnœa, or even slow but fatal asphyxia, the lung tissue meanwhile containing marked traces of the passage of the parasite. There are cases where the bronchia in the lungs of the calf are so invaded that the lobules furthest from the larger bronchial tubes are denied

the entrance of air. The strongyli accumulate in hundreds in inextricable pellets which the air cannot traverse. Thus these lobules appear to be hepatized."

"The strongyli fill the bronchia of the calves' lungs during the first year, but they do not long obstruct them; they die and are eliminated at the end of a season."

"This is the mode of reproduction of these worms: The females, twice as large as the males, have a long resistant oviduct, sinuous and folded upon itself, containing, from its depth to its terminal orifice, eggs in all phases of incubation. At first they are scarcely recognizable; afterwards are others of which the yolk is divided into 2, 4, 8, or 16 spheres, and whose surfaces are irregular, like that of a raspberry; further on, the eggs contain a curved immovable embryo; at last an embryo in the form of the figure 8, in a loop, or in a spiral, like the Trichina in its muscular cyst."

"It is not necessary that the female should remain alive in order to the laying of the eggs; even when she dies the expulsion of her progeny is assured. If she lays them in the bronchia, the young ones are developed or expelled. If her progeny must be preserved for a more propitious season, or for another age of the animals which harbors them, she encloses herself in a tubercle in one of the air sacs, afterwards dies and is transformed into a veritable bag of eggs, destined to furnish, insensibly and for a long period, the contingent which the living worm would have been able, in other circumstances, to render at one laying."

"The two habitats of these worms thus coincide each with one period of their life and with certain circumstances of their reproduction. In the cyst they hatch successively with a certain slowness, remain small, asexual, and live surrounded by the debris of their mother. Later, they develop in the bronchia, become sexual, adult, copulate, and prepare, it may be, for emigration externally, it may for a new (*internal*) reproduction in the lungs, during which they constitute numerous reserves for all the period of the life of the mammifer, as is a possible case, not for the calf, but for the sheep."

"*Out of the body* of their host the life of these worms in water

is thus described by Colin: "After the death of the mother its body swells, its skin is torn off, and the oviducts float free, and masses of eggs and myriads of embryos escaping disperse themselves at the bottom of the water. I have watched for eight days in succession the continuance of this hatching, the little ones always showing the same vivacity alike in the clearer parts of the water and in the vicinity of the detritus from which they have sprung. Whilst a certain number died, there still remained a prodigious quantity, soon, however, becoming mingled with infusoria developed in the liquid."

"There are here two facts: the birth of the worms in the dead body of their mother, and the external life of the little ones, the cause and condition of the contagion. In effect, the animals, of which the bronchia conceal the strongyli, reject them under the influence of cough and the expectoration of mucous charged with worms, which fall on the food, the litter, upon the soil, or in the water drunk; the mothers die, but the eggs are hatched, and the living brood wait till they have the opportunity of entering the bodies of the animals. It is, above all, in water that they are long preserved outside the animal economy. I have watched them in pools of fresh and stagnant water, the one destitute of vegetation, the other penetrated with confervæ or covered with lentiles, dead leaves and divers debris. The adult worms died at the end of some days. From their carcases the oviducts escaped, carrying with them eggs in all stages of development. Incubation, already well advanced during life, is continued without interruption. The embryos are expelled from the shell and dispersed in the water during one, two, three, four, five, or six weeks, according to the temperature and other conditions of the liquid. The development takes place more regularly in fresh water than in salt; in river than in spring water; in pools with lentiles and confervæ than in pools exposed and slimy. It was notably retarded, but not suspended, in fetid water charged with carburetted and sulphuretted hydrogen. These worms are so tenacious of life that their evolution takes place in the customary manner, even in water in which portions of the infested lungs have been macerated.

The septic element disengaged from these putrid fragments retarded the development of the strongyli, but failed to arrest it. And even if the experimental troughs contained a very large amount of water, the strongyli disengaged themselves in great numbers from the morsels of putrid lungs; and, though reduced to a putrid pulp, the eggs could be seen amidst this ready to open, and the young worms escaping from their envelopes."

"It is in fresh water that the worms are most readily developed, and live longest after leaving their natural habitat. Water is a transition medium in which the worm which has abandoned one animal can survive, waiting a favorable opportunity to enter another. In this medium the strongyli are hatched and live for entire weeks and months without perceptible growth, that is to say, they preserve their primary microscopic proportions. They can there resist sudden changes of temperature and the deleterious influence of putrid matters, whilst they wait an occasion of entering with the aliments into the body of a new host, in whose air passages they find the conditions necessary to their assuming the attributes of sexuality and reproducing their kind.

Causes.—These are, of course, primarily and mainly the introduction of the embryo strongyli into the system, but many other conditions may combine as accessory to the preservation and propagation of the worms. Thus, *wet seasons*, by providing moisture or pools for the preservation of the embryos, contribute to their wider diffusion. In keeping with this we find the first record of the disease as existing in the low wet grounds of Holland, and the two by Despallens as occurring in the wet summers of 1795 and 1811. The same holds good in England alike as regards the prevalence of the disease in the low fenny counties, and in rainy seasons; and these remarks apply to other animals as well as calves and lambs. A donkey, from the low meadows at Hammersmith, London, rarely failed to yield a supply of the strongyli. And in the present year, which has proved unusually cold and wet in the British Isles, we are not surprised at the serious complaints of the extraordinary death of pheasants from *gapes*.

The cows on Mr. Swift's farm at Cuba, with which the disease probably originated, were pastured in a new field full of stumps and brush, and abounding in springs and marshy places. A *second accessory* is to be found in the *youth of the animals*, the weakness of which and the abundance of secretions from their mucous membranes predispose to this as to other parasitic affections. *Weakness* from ill health or old age may be classed along with this. But, perhaps, the most important of these accessory causes is feeding on *contaminated fields or fodder*, or drinking from *troughs or streams containing the worms*. In the affected counties of England calves and lambs are especially liable to suffer, if pastured on fields previously eaten down with older stock. Overstocking has also its evil influence, partly by reason of its weakening the constitution of the animals, and partly by causing an extraordinary accumulation of embryo strongyli in the pastures and drink.

Symptoms.—The symptoms are esentially those of bronchitis, with this difference: that the examination of the mucous coughed up shows the presence of the worms either solitarily or rolled together into bundles. The symptoms, however, vary a good deal in different cases. There is, at first, only a slight cough, rather hoarse and hacking, and repeated at irregular intervals. The coat stares, the skin feels dry, inelastic and unhealthy, and emaciation perceptibly advances day by day. Sometimes the cough is not observed at first, and these symptoms alone, or with some slight embarrassment of breathing when exercised, are the sole manifestations. Soon, however, the cough becomes more frequent and occurs in paroxysms which threaten suffocation, and sometimes induce it. The matters expelled by the nose and mouth are found, on examination, to contain more or less of the worms, appearing like pieces of stout white thread, one to three inches long.

Often when the cough is less frequent, it is at the same time soft and loose, or even wheezing rather than hoarse; the patient becomes daily weaker and more hide-bound, the visible mucous membranes get pale, the eyes sunken, the ap-

petite fails, the animal leaves its fellows and may be found in a corner of the pasturage or under a tree, its skin covered with vermin and flies, which it no longer has the vigor to brush off. The patient finally dies in a state of extreme weakness.

Worms in the bowels often form a serious complication, though one too much overlooked. From the presence of these arise indigestions, tympany (bloating), and above all, diarrhœa, which rapidly exhaust the strength and hasten death.

The parasites found in the intestines of oxen in such cases are chiefly: the Strongylus radiatus, in the small intestines, and the Tricocephalus affinis and occasionally the Sclerostomum hypostomum in the larger intestines. These are merely the common parasites of the ox, which increase in direct ratio with the debility and the improper condition of the aliments. The same holds good in the horse and ass. In similar conditions their small intestines contain the Ascaris megalocephala, and their large intestines the Sclerostomum equinum, the S. tetracanthum and the Oxyuris curvula. To describe these worms at length would unnecessarily extend this paper, and serve no good purpose.

Duration.—In ordinary cases, calves will live two or three months after being attacked, although the blocking up of the windpipe or principal bronchial tubes by pellets of worms, or the accumulation in the lungs of ova and embryos to the extent of causing a general inflammation, may at any time precipitate death. Mr. Swift's calves died at periods of from nine to fifteen days after they were noticed to be ill." * *

"*Prevention.*—Two indications present themselves as calculated to prevent this disease:—1st. To prevent the worms from gaining access to the system; and 2d. To bring the animal into a condition unfavorable to the development and destructive work of the worms.

Under the first head might be mentioned many specific precautions: 1st. In localities where the parasite is known to exist, *lambs or calves should not be depastured on land recently*

occupied by sheep or by older cattle or horses. Lambs may be safely grazed after horses or cattle, or foals and calves after sheep, but no young animal in such place should be allowed to graze after any creature liable to harbor the specific parasite, to whose attack its lungs are obnoxious. 2d. *Overstocking should be avoided.* If the parasite is introduced on any pasture, the facilities for its increase will be in exact proportion to the number of animals present in whose lungs it can attain full sexual development and reproduce its kind. 3d. *Thorough drainage will go far to prevent it.* As the young worms must live in water or in moist earth, the facilities for their preservation will be increased according to the springy or marshy nature of the soil. 4th. Young stock must not be allowed access to water coming from a field containing beasts infested with its own pulmonary parasite. 5th. Pastures or water in which any particular pulmonary parasite has gained a footing should be denied to all animals known to harbor that particular parasite, or still better, the soil may be torn up with the plough and subjected to a rotation of other crops until time has been allowed for the destruction of the germs. 6th. No affected or suspected animal should be placed with others, nor in their pastures, until time has been allowed and measures taken to rid it of the unwelcome visitant. 7th. Feeding young animals on grass wet with dew, or on clover or other such fodder as affords by its abundant moisture a suitable nidus for the young worms, is to be avoided. 8th. Carcases of those dying of the affection should be deeply buried.

The testimony of English farmers is strongly against second crop grass, and above all, clover which has been fed off with sheep or beef cattle, as the case may be, in the spring; and that eminent Prussian breeder, Baron Von Nathunsius, Hundisburg, Magdeburg, asserts that though the *filaria* in lambs was formerly very frequent and pernicious in his neighborhood, he has not observed it for twenty years, since they took to feeding the lambs in sheds, on hay and roots, during the wet season.

Under the second head, that of enabling the animal to resist the worms and their effects, may be mentioned: 1st. The

importance of good feeding; and, 2d. The value of a free supply of salt. Most English flock-masters speak of the necessity of keeping the lambs in good condition, partly with the view of enabling them to prevent the worms from effecting a lodgment in their bodies, but mainly to enable them to survive the depressing effects attendant on the presence of the parasite. One man finds that the fatality of the disease diminishes very materially where his lambs are fed roots; another lauds oil-cake as being nearly a preventive, and a third saves most of his lambs by feeding well after weaning. The disease is found to be quite as prevalent in wet seasons as in dry ones, if not more so, but the mortality always increases with the dryness, and the lack of nutrient food. The use of salt is based on the fact elucidated by Dr. Crisp and others, that contact with a solution of this agent is promptly fatal to the young worms.

Remedial Treatment.—This resolves itself into: 1st. Supporting the strength of the animal; 2d. Destroying the intestinal and pulmonary parasites; and 3d. Combating pneumonia or any other complication which may supervene. Attention must, of course, be given to prevent the access of more parasites to the system by partaking of contaminated food, water, or mingling with diseased flocks or herds.

To support the strength, the patients must be liberally fed on oil-cake, rape-cake, roots, corn, oats, beans, or other sound nutritious diet, to which may be added a mixture, in eqnal parts, of powdered sulphate of iron, gentian, and ginger, in the proportion of four ounces of the mixture to every ten calves, daily—lambs may take two ounces to the same number, daily, at three months old.

To destroy the intestinal parasites, common table salt may be given to lambs in doses of a teaspoonful every other morning, dissolved in water, and to calves in doses of three teaspoonfuls. Oil of turpentine is perhaps, more efficient, and may be given to strong three months lambs in doses of two teaspoonfuls, or to calves of the same age in doses of a tablespoonful, well shaken up in milk. These doses should be given in the morning fasting, and repeated the third day.

To dispose of the lung parasites is a more difficult matter, not because the worm is less easily killed, but because the young worms and, above all, the ova encysted in the substance of the lungs cannot be reached. The worms living free in the windpipe and bronchia may be readily destroyed by causing the affected animal to inhale sulphurous acid or chlorine gas. The agent first named is preferable as being less irritating than chlorine, as exercising, indeed, when sufficiently diluted in air, a soothing and antiphlogistic action on the inflamed bronchial mucous membrane. It is best administered by burning flowers of sulphur in a close house, but into which air can be readily and freely admitted in case of need, and in which both the patient and administrator are enclosed. It is commonly advised to throw sulphur on hot coals, but, as the latter give off carbonic acid and render the air unwholesome, I have adopted the plan of twisting up a small piece of soft paper into a cone, putting into this a pinch of sulphur and burning it, holding meanwhile by the twisted point of the cone. The sulphur fumes are to be evolved in this way until the air of the apartment is impregnated as strongly as the administrator and his patient can bear without violent coughing. Breathing of the sulphur fumes should be kept up for half an hour or as long as the air of the building remains impregnated with it, and should be repeated at least three days in succession. At the end of a week, should the patient survive, the smoking should be repeated to destroy the parasites which have been hatched in the interval. The same process may have to be repeated once more, though if the ova in the lungs are so numerous as to endanger life after this, the inflammation caused by their presence will probably speedily cut off the patient.

Chlorine gas may be set free by mixing in a cup or saucer common salt, peroxide of manganese, and sulphuric acid. It is equally efficient with sulphur smoke, but much more irritating and to be used with greater care. Indeed, this matter of smoking by either agent should only be trusted to the most careful and intelligent persons, otherwise serious accidents may ensue.

In the worst cases the accumulation of worms and ova in the lung tissue produces an extensive inflammation of these organs and renders all treatment unavailing. This has been treated by blistering, wine, &c., but rarely with any measure of success."

The Strongylus of the Hog's Intestines, (*Sclerostomum dentatum* Rud.) See p. 241, Report for 1870.

In the last report this species was erroneously described as a true *Strongylus*, owing to the probable occurrence of two different but related species in the hog's intestine, one of which is probably a true *Strongylus* and the other a *Sclerostomum*. The original species described by Rudolphi appears however to belong to the genus *Sclerostomum*. According to Diesing, it had the following characteristics, some of which differ from the description given in the Report for 1869.

Head truncate; border of the mouth with ten or twelve small recurved teeth. Body straight, tapering to both ends. Bursa of the male three-lobed, the intermediate lobe smaller; rays three, undivided. Caudal extremity of the female straight, subulate, the genital aperture above the apex of the tail. Length of the male, 5 or 6 lines; of the female 6 to 7 lines; diameter one-fourth of a line.

The "Kidney-worm" or "Lard-worm" of the Hog. (*Stephanurus dentatus* Diesing, or *Sclerostoma pinguicola* V. Report for 1870, p. 248.)

Since the publication of the last report much additional information has been obtained concerning this destructive parasite, which proves to be one of the most abundant and widely diffused of all those infesting domestic animals. It is also probable that it annually causes greater pecuniary loss than any other parasite.

Soon after the publication of my description of this worm in the last report, and also in the *American Journal of Science*, my attention was called to several other cases in New England. In one of these, numerous large specimens were found in the leaf-lard of a pig raised in Litchfield county, in this state.

These occupied large irregular cavities or cysts, sometimes an inch long, containing a considerable amount of dark colored and disagreeable matter, like pus, in which many eggs were also found. In some of the cavities two or three worms occurred together, in others but one. This pig had been dressed and sold in New Haven as sound and healthy. By an examination of these fresh specimens and others I have been able to determine the form and structure of the worm more precisely than could be done with the badly preserved specimens originally described. Soon afterwards I received drawings and specimens of the same parasite from Dr. Wm. B. Fletcher, of Indianapolis, Ind., who had also sent specimens to Dr. Cobbold, with information concerning its habits. Dr. Cobbold identified the worm with the species described by Diesing* from specimens obtained by Natterer in Brazil in a Chinese variety of the hog. He also published an article on the subject in the *British Medical Journal*, and in "*Nature*," Jan. 26, 1871, calling attention to its importance. I have also satisfied myself that this identification is correct, on examination of the perfect specimens referred to above, although Diesing's description does not apply in all respects to the specimens which I have examined. Dr. Cobbold errs, however, in supposing that this species has been entirely overlooked in this country up to this time, for in 1858, Dr. J. C. White† noticed the occurrence of the same worm (which he referred doubtfully to *Stephanurus dentatus*,) in the leaf-lard of a hog. It appears to have been well known to pork producers for a long time under the name of "kidney worm." Dr. Cobbold has published another more lengthy article on the same subject in *Nature*, Oct. 1871, p. 508, in which he translates Diesing's original description and gives interesting facts received from Dr. Fletcher concerning its habits and injurious effects in this country. He also records its discovery in Australian hogs by Dr. Morris.‡

*Systema Helminthum, Vol. ii, p. 296, 1851. Also in Annalen des Wiener Museums, ii, p. 232, Tab. xv. (anatomy), 1839.

†Proceedings of the Boston Society of Natural History, Vol. vi, p. 428.

‡Monthly Microscopic Journal, Nov. 1871, p. 243.

Dr. Fletcher had, however, already published an interesting and important article on the same parasite in the *American Journal of Science*, June, 1871, p. 435, from which the following extract has been taken:

"This worm was brought to me in 1866, by a farmer whose hogs were dying of cholera. He had removed the lungs of several, and also cut out fragments of the liver, all of which were spotted over with little cysts containing the worms; in the bronchial tubes down to the minutest branches, they were found in abundance and in situations where no one could have placed them.

With these specimens my conclusion was that they were the *Filaria bronchialis* of Owen, or *Strongylus bronchialis* of Cobbold, and not having at this time made microscropic examinations of our well known kidney-worm, the relationship between them did not occur to me at that time.

In November, 1870, while demonstrating the portal circulation in the liver of a pig, full grown, I observed a worm which measured an inch and a half in length, and in all respects resembled the kidney-worm, and also reminded me of the worms I had examined five years before. Upon further dissection of the liver I found the worms not only free in the portal veins, but in cysts in various portions of the organ; also some were found in freshly cut holes, directly across the hepatic lobules. The gall-bladder was distended with a dirty yellowish fluid, the consistency of soft boiled eggs, and although no worms were found, yet the ova were abundant, as they also were in the fluid of the cysts.

Being convinced that the worm formerly examined in the lungs was the same as the worm now found in this new locality, and finding it oviparous, I gave up my opinion as to its being a *Filaria bronchialis*.

From the date of this discovery, I frequented the slaughter houses and pork-packing establishments, and found the worm in most instances in the pelvis of the kidney, or in cysts in the fat around them. Four times I have found the worm in the bronchial tubes, twice in the hepatic vein and the right side of the heart; also in cysts throughout the fatty parts of the animal.

Frequently, when no worms were discovered, the eggs were abundant in the thick mucus-looking fluid in the pelvis of the kidney. This fluid contained, besides eggs, desquamated renal tubules, or casts and oily granules.

In no instance have I found worms in an immature state, which shows that the eggs, in all probability, go through some other host before they enter the swine, to become sexually mature.*

The symptoms in hogs, which are referred to the "kidney-worm," are due to a paralysis of motion in the hind legs; the hog draws the hind quarters along the ground from place to place in search of his food, although it is by no means proven that the worm is the real cause, unless we be able to demonstrate its existence in some cerebro-spinal center, or some point more likely to destroy the reflex power in the cord itself.

Structure.—The head and oral cavity are alike in male and female. The oral cavity is rather oval than round, and is surrounded by a hexagonal frame, each corner having a papilla and hooklet, while each side is armed with six serrate teeth.

Looking into the oral cavity, it is funnel-shaped, having three openings at the back, one of which connects directly with the œsophagus, while the others appear to connect with the water vessels.

The intestine is long and contains some pigment granules, arranged in dentritic forms, throughout its length; the whole is thrown into convolutions, and gives an almost black appearance to the worm, except when the white oviducts distended with eggs, or the seminal vessels of the male are folded over the intestine, when it has a white, mottled appearance.

The caudal extremity of the female is spindle-shaped, but has two little bursæ higher up. In the male it is formed by three-lobed bursæ, above which are two well developed flexible spicula."

*It is quite as probable that they may hatch in water, and thus enter the hog's stomach with its drink.—V.

I may add that in fresh or well preserved specimens the caudal extremity of the male terminates in three conical, obtuse papillæ, from the midst of which the slender, curved male organ often projects; these papillæ are nearly enclosed by the " bursa," which is close to the end of the body. When spread out and seen from behind this has a somewhat rectangular form, being broadest laterally, each of the lateral expansions consisting of two small lobes united together to near their ends, while the intermediate odd lobe is shorter and scarcely prominent. Or the bursa, instead of being called five-lobed, as described by Diesing, might, with equal propriety, be described as consisting of two larger, bilobed lateral lobes, and a smaller intermediate lobe which is closely united to them. The caudal end of the female is blunt, suddenly narrowing to a small, obtuse papilla-like tip, which is placed excentrically; a short distance in advance of the end are two small, rounded, vesicle-like, lateral prominences. The dark, chitinous ring around the mouth is finely denticulated along its edge, and usually bears six stronger teeth, two of which, on opposite sides, are usually larger and stouter than the others, but not invariably so; sometimes, especially in the larger females, they are more than twice as large as the rest. In some specimens I also observed two opposite papillæ near the mouth, from each of which a minute, short, slender spine projected. The anterior end of the female is more obtuse than that of the male. The largest females from the Litchfield county pig were 1.75 inches long and .08 to .10 of an inch in diameter. The largest males were 1.35 long and .06 thick.

Dr. Fletcher writes that he believes that this parasite causes greater pecuniary loss than any other known. He has found it in nine out of ten hogs examined. He also suspects that it may be the cause of the hog cholera.

Some experiments undertaken by me to trace its history and development have not as yet thrown any light upon the subject. We are still in complete ignorance concerning the circumstances under which the eggs hatch and the abode of the young worms. Until such information can be obtained

no reliable advice can be given as to the modes in which the spreading of the disease can be best prevented. It is most probable, however, that the eggs are hatched in water or moist earth, and that the young worms are swallowed directly by the hogs while drinking.

Although this parasite probably does not live in the human body in any stage of its growth, there can be no doubt but that the pork and lard from hogs infested by them must be unwholesome. That such diseased pork is constantly sold in our markets is certain.

The Human Bot-fly (*Dermatobia noxialis?*).

In the last Report (page 95), it was mentioned that a species of bot-fly lives in the larval state beneath the human skin, forming painful tumors. But such instances had been observed only in the tropical parts of Central and South America. It is, therefore, of interest to record a similar case in the United States. In this instance, a young woman, twenty-two years old, residing at Meridian, Mississippi, was the victim of the insect. The larvæ, developed from eggs deposited in the skin by the fly, caused great irritation and pain in the sub-cutaneous tissues, resulting in large abscesses, from which the mature larvæ finally escaped.

I am indebted to Dr. Wm. B. Fletcher, of Indianapolis, Ind., for a specimen of the larvæ of the insect which was taken from this patient and sent to him by Dr. Jas. Hughes, who treated the case. Whether it be identical with the South American species cannot be determined from the larvæ alone.

HENRY A. DYER.

BY M. C. WELD, NEW YORK.

It is certainly meet that the death of one, for many years so actively interested in Connecticut Agriculture, and in the Societies established for its improvement, should receive more than a passing notice in this volume. Besides, the history of improved Agriculture in this state, which these reports should

in a measure furnish, would be incomplete without a sketch of a man who was in these matters long so prominent and influential.

Henry A. Dyer was born in Providence, R. I., February 18th, 1819. He died at his home in Newark, N. J., July 2d, 1871. Mr. Dyer sprung from an ancient Providence family, and was the only son of Paris Dyer, a prominent and enterprising merchant of that city, whose death preceded that of his son by only a few months. He enjoyed all the educational advantages which excellent schools and access to choice literature, both ancient and modern, can offer a studious youth of keen and quick perceptions, fine natural tastes, and surrounded by cultivated people. His training was with a view to mercantile life, but his rural tastes led him to become associated with his father, whose tastes were similar, in an extensive agricultural enterprise in Windham County, Conn. Here, purchasing a large farm, they established the subsequently well known "Raspberry Hill Nurseries," which they made famous as furnishing a supply of excellent fruit and ornamental trees and shrubs, and especially of evergreens.

Mr. Dyer's first practical knowledge of farming was gained at a time when theoretical agriculture may be said almost to have run wild. The agricultural press of the day, and the daily newspapers, as well as many books written upon the subject, were calculated to stir the enthusiasm and kindle the ambition of any young man. This was just tho time when so much was written and said about soil analysis, when so-called professors of agriculture analyzed soils and gave prescriptions for producing infallible fertility; a time when quackery was fairly rampant under the guise of science, deceiving thousands, causing millions of money to be wasted, disgusting sensible, practical men with the name of Science as applied to agriculture, and doing mischief in every way. Whatever was written upon improved agriculture was read with avidity by Mr. Dyer, and when the late Prof. John P. Norton gave his first courses of lectures at the Scientific School of Yale College, upon Scientific Agriculture, Mr. Dyer was among his pupils, and certainly one of the most appreciative of hearers.

His were the first courses of lectures on agriculture, accompanied by systematic instruction in chemistry, ever given in an American university, and their influence upon Mr. Dyer was to lead his quick judgment to separate genuine from false science, and fact from fiction in the agricultural writings and teachings.

Long prior to this, he had marked the benefits arising from the association of farmers for mutual improvement, by comparing experiences, interchanging ideas and ends, reading and discussing the same books and periodicals. How often he would say that every man had or thought he had some knowledge which might be valuable to his neighbors — every man was or should be able to *do* something better than it was usually done; and that the Farmers' Club was the place where all should cast in their best thoughts for the benefit of all.

With the new inspiration acquired at Yale College, his efforts to establish a Farmer's Club in the town of Brooklyn were very successful: circumstances were peculiarly favorable. The town is in a fine farming and fruit region, formerly a part of Old Pomfret, famous for its good farming, good stock, apples, Putnam's home, and the wolf den. The farmers, many of them belonging to old and honored families, were intelligent and, many of them, educated men. The Brooklyn Farmers' Club was practically so marked a success that it made its influence felt in all parts of the State.

Mr. Dyer exerted himself with increased zest in favor of improved Agriculture in his adopted State. At no small expense of time and money, he obtained lecturers and went with them through the various towns in Windham County, gathering the farmers in public meetings, and securing the formation of Clubs in all the principal agricultural centers. When the interest in improved farming was fairly roused, and the more intelligent farmers saw the benefits to their own practice to be derived from association in this way, a County Agricultural Society on a permanent basis was the natural result; and it needed only the skill and common sense, with uncommon foresight and knowledge of human nature, which Mr. Dyer always displayed in such matters, to establish it

upon a basis where it should long remain one of the most active and useful organizations of the State.

A letter received from Rev. R. Camp, Brooklyn (Ct.), gives so just a view of Mr. Dyer's career as an agriculturist, and his wide good influence in Windham County, that it may be properly introduced here. He writes as follows:

"DEAR SIR:—

"I cannot give you many facts of Mr. H. A. Dyer's Agricultural life. He commenced his farming on Raspberry Hill under most disadvantageous circumstances. The soil was cold, wet, and heavy, the land better paved than many of the streets in the city of New York are represented so to be. But he threw into his calling all the enthusiasm and force of will which afterwards distinguished him. Chemists were then making confident assertions of ability to analyze soils and tell what ingredients were needed to make them produce any given crop. He became a believer and a victim of the theory, sinking a small fortune in experiments which taught him wisdom, but brought no other gains, except to others, for he used the wisdom thus gained for the large benefit of the State. With peculiar clearness of discrimination, he perceived that agricultural improvement must depend upon the accumulation of well tried facts and their spread. Accordingly, he set himself at work with his usual ardor and application to get together the farmers of the town, and have each one contribute such information as he had practically acquired for the benefit of all. In the year 1850, he succeeded in forming a Farmers' Club, which met at regular periods, subjects being given out and disputants appointed, after them, any member speaking who pleased. This proved a very profitable and pleasant association, and led to great changes in individual practices. The town owes a large debt of obligation for his wise and generous services. By his indefatigable exertions, this Club fruited into a County Association, and his foresightedness secured its permanence by providing for life memberships. This society did much for the county by stimulating fruit growing and flower culture, and affording facilities for their development. Mr. Dyer gave his time, and mind, and

body to the promotion of the farming interests of the county, shirking no labor and sparing no pains. Unselfish and full of zeal, he did what few men do—lived for others and begrudged not his toil.

Yours truly, R. CAMP.

Brooklyn, Conn., April 12th, 1872."

The subject of a *State Agricultural Society* had been repeatedly discussed by gentlemen interested in the agricultural progress of Connecticut. The county agricultural societies with some exceptions were dead-and-alive affairs. Living only to make an annual show, and sometimes waking up to holding fine exhibitions and manifesting a good deal of vigor, and then dozing lethargically for several years or else splitting up into two or three local societies. When the subject of the State organization came again to be mooted, Mr. Dyer took hold of it, as he did of everything else that was good, with his whole soul. His coöperation had been sought, but soon those who sought his aid were glad to aid him; and, though willing to be led, he proved the natural leader, and without offense, really moulded and formed the State Agricultural Society. With little aid he framed the bill which granted the charter, wrote the constitution and by-laws, incorporating the good suggestions of others quickly and easily secured great harmony of action and a thorough enthusiasm about it in all parts of the State.

The charter was granted and the society organized in 1852. Mr. Dyer was elected corresponding secretary, and retained this position for eight years. This position made him virtually the business manager of the society. The president, Mr. T. S. Gold, and Mr. Dyer, constituted for a long time the sub-committee of the executive committee, and were the real motive power. For a considerable time the meetings of the sub-committee and of the executive committee were held at the office of the writer of this, and he had occasion to observe Mr. Dyer's breadth of views, accuracy of knowledge, in business matters, as well as in matters of policy, in law, etc.; and his tact in sustaining his points and winning over those who dissented.

The state agricultural society under his management, had the active and cordial coöperation of all the county societies. It held a number of fairs, which, as instructive exhibitions of live stock, and the products of the farms, gardens, and of the manufactures of the state, were really wonderful, and acknowledged as unequaled at the time, even by the shows of the United States Agricultural Society, or by any state society.

It was chiefly through his influence that the publication of "The Homestead" was commenced in 1855, which, until after the breaking out of the great Rebellion was published at Hartford, and was the recognized organ of the society. Mr. Dyer was one of the four gentlemen who were associated as editors of The Homestead. His writings were notable for their distinct aim, for their perspicuity, and for always leaving a valuable impression upon the mind. The annual reports prepared by him, in addition to the regular and necessarily dry details of the operations of the state and county societies, were written in an interesting and perspicuous style, and were replete with useful information. Through Mr. Dyer's influence as corresponding secretary, Professor Johnson, of the Yale Scientific School, was appointed chemist to the society, and that remarkable attack upon fraud in fertilizers was made during the years 1866, '67, and '68. The facts developed by it have ever since been working among agriculturists like leaven. The fertilizers examined were obtained personally by the corresponding secretary chiefly from the hands of the farmers who bought them for use, and the result of the analysis showed not only what commercial fertilizers were of the greatest value, but to what an extent the farmers were defrauded in the purchase of many kinds supposed to be of the most reliable character. These exposures, and the knowledge disseminated among the farmers then, and more or less ever since, have made Connecticut farmers enviably secure from loss from these despicable frauds.

As an agricultural writer, Mr. Dyer was strong, clear, convincing, and matter of fact; avoiding anything that looked like ornament, yet all that he wrote was not only practically excellent, but very pleasant reading.

With his retirement from the secretaryship of the society in 1860, after holding it about eight years, his services to the cause of improved agriculture mainly ceased, for he devoted all his energies to the subject of life insurance, being first connected with the Travellers Insurance Company of Hartford, and subsequently with the New York Life Insurance Company, as general agent, which laborious and responsible position he occupied at the time of his death. His quick discernment of character and ability to measure the capabilities of men, together with his tact in inspiring those around him with his own enthusiasm, rendered him peculiarly well adapted for the place which he very acceptably filled.

Mr. Dyer's general health was good, but he suffered exceedingly from frequent attacks of asthma, which when severe greatly exhausted him. It was after one of these attacks experienced while traveling for the company at the West, that he returned home really broken down, and never recovered his usual health, but gradually sunk and finally died at the age of 52, at his home in Newark, N. J., where he had resided several years.

In 18 Mr. Dyer married a daughter of Mr. —— White, of Brooklyn, Conn., who, with two sons and a daughter, survive him. His home was always one in which cheerfulness, culture, refinement, good taste, and the most cordial hospitality made every guest at ease, and left an impression of family felicity not easily effaced. He was a devoted son, a tender and loving husband and father, and a firm friend.

We are tempted to write at greater length in regard to his fine literary tastes, his love for poetry and art, his interest in every good and useful project or discovery, but forbear. He read rapidly and retentively, and his mind was full and overflowing with ideas, making him a most interesting companion. He formed a few but strong friendships, and retained them, while cordial and friendly towards all. His religious convictions were definite and his faith strong, both in life and in death.

Mr. Dyer never lost interest in agriculture, but his energies were expended during the last ten or twelve years of his life

in other channels, still it is as an agriculturist that he was best known and will be longest remembered—and in closing this very brief and imperfect sketch of his life, we are forced more than ever to admire the man in the multiform relations of life. He made little wealth for himself, but from our first knowledge of him devoted his energies to the advantage of others. In his life he was loved and honored, and in his death sincerely mourned.

REPORTS OF THE DELEGATES TO THE COUNTY EXHIBITIONS.

NEW HAVEN COUNTY.

As delegate from the Board of Agriculture to visit the Fairs to be held in the County of New Haven in 1871, I would submit the following brief report:

The Milford and Orange fair was held at Milford on the 27th and 28th days of September. The Woodbridge and Bethany fair was held on the 28th day of September. Both of the above fairs I was unable to visit in consequence of prior engagements.

The Union fair was appointed at Morse's Trotting Park, in Wallingford, on the 10th and 11th days of October, which fair I visited on the 10th, but owing to the 11th being rainy, it was put over until a future day.

The exhibition of Trains of Cattle was in a field near the park, where there was one train of 62 pairs of oxen from the East Farms, Wallingford, one train of 46 pairs from Meriden, and one train of 44 pairs from Cheshire. The oxen were most of them very good ones, and many of the pairs were very heavy; large, finely made, closely matched, mostly of the deep red color for which Connecticut cattle have been noted. There were also a few pairs and single fat cattle, which were

very good. Also, a few cows, mostly grades; but not showing very extra marks either as milkers or grades.

On the park were a few Alderney and Dutch cattle, and cows; some of the cows good specimens of those breeds.

There were on exhibition several mares and colts; some of the colts very good ones; also, quite a number of driving and farm horses, which were good; and one four-horse team, very large, strong-built horses, hitched to a very fine strong-made heavy wagon used for drawing brick. The wagon was made at North Haven, and with the four-horse team owned there. A few sheep and a few swine were also on exhibition.

In a large tent was quite a display of various articles of farm and mechanical productions.

Of apples there was quite a collection of varieties, and some of them very superior specimens of their kinds; but some varieties were not as good as they should have been, perhaps owing to the very dry season and the light soils on which they were grown.

Of pears there were some forty varieties shown by the various exhibitors, some of them very good specimens, others poor and past their season of ripening.

There was a number of baskets of Quinces, and some of them as large and fine shaped as I have ever seen.

There was a very large exhibition of Grapes, of numerous varieties; some were very fine in the size and fullness of the bunches, and in the size of the grapes. Some of the grapes were shown on the vines as they grew, which showed very strong canes with the bunches thickly set; the bunches large, well filled, and the quality of the grapes good and well ripened.

Of canned fruits, there was a large show, including berries and tomatoes, most of them very fine looking.

Samples of several kinds of domestic wines (so called) were presented by several exhibitors, some of them good.

There was a fair show in numbers of squashes and pumpkins, some very fine ones, but most of them were mixed varieties. Also a few samples of fair corn and rye, and some good oats.

There was a large show of potatoes and quite a number of varieties, most of them good specimens; the Peach-blow being most numerous, very fine and smooth, and some of them very large.

There were a few very large cabbages, weighing from 35 to 37 pounds; also some others of a fair size, and some of the smaller kinds.

There were a few samples of turnips, large and solid; some very large large beets (too large to be good); some very fine, large carrots and parsnips, good shape and smooth; also some very large, long red mangolds, good egg plants, cauliflowers, watermelons, musk-melons, citrons, etc.

Ten samples of butter were exhibited which looked nicely and were of good quality.

There was also a good exhibition of household manufactures and fancy articles, some of which were very good. Three cases were on exhibition by the Oneida community, containing sewing silks, ribbons, and other articles manufactured by them; also stuffed birds, birds' eggs, Indian curiosities, etc., which drew a great deal of notice.

I would return my thanks to Mr. Wm. D. Hall for his courtesy to me during my visit to the fair.

H. L. STEWART.
Delegate to New Haven County.

FAIRFIELD COUNTY.

To the Hon. Board of Agriculture of the State of Connecticut:—

Having, according to appointment of the Board, visited the Annual Fair of Fairfield County, held at Norwalk on the 19th, 20th, 21st, and 22d days of September, 1871, we would respectfully present the following statement:

It is a matter of interest to know that the Fairfield County Agricultural Society is one of the oldest in the State, having had an existence of thirty-one years, during which time it has passed through seasons of prosperity as well as seasons of adversity; as an evidence of the latter fact, it is stated that

this Society has once held a fair of which the total receipts were but seventeen dollars.

And when we consider that, under the cloud of so adverse circumstances, the men of Fairfield, who then represented the farming interests of the county, undismayed at the result, fearlessly adhered to, and sustained their organization, it is not surprising that we should at this time behold a happy contrast. One fact is certain, that it matters little what the organization may be, unless those persons whose welfare it is intended to promote take sufficient interest in it themselves to sustain such organization, it will not prosper; and another fact is as certain, that such persons who fail of sustaining institutions designed to benefit their calling, have but a partial interest, or an unhealthy one, in the business which they profess to follow. On the contrary, we may always be safe in judging that those persons who represent agricultural pursuits, who are deeply interested in the success of agricultural fairs and other efforts of associations for mutual benefit, are such as are prosperous in their farming operations, and are always ready to acknowledge the sources from which the benefit is derived. So then, in one sense the support of Agricultural Societies by attendance upon fairs, etc., is a general index to the agricultural standing of the community in which the fair is held; taking this as a criterion by which to judge, there is unmistakable evidence of the deep interest felt by the people of Fairfield County in the cause of Agriculture, second, indeed, to no county in our whole State. In fact, this county evidently (and perhaps justly, too) prides itself upon its high position, which is certainly a good omen, for when once a healthy and laudable ambition is excited, the desire to hold an honorable position seldom dies out; and perhaps it would be well if a spirit of competition between different portions of the State could be excited, since all competitive efforts must of necessity result in general advancement. In another point, also, can general agricultural progress be discovered, and that is in the increased size and value of the various vegetables, and in improvement in grains, for although the products of the soil, as they are exhibited at

our fairs, may not always present a true idea of the general crop raised by the exhibitors, still in a comparison of the exhibitions of to-day with those of fifteen or twenty years ago, the improvement in the products is a safe guide to judge of the general progress, and if the person who "causes two spires of grass to grow where only one grew before is a public benefactor," then is not the man also a "public benefactor" who causes vegetables to grow to twice the size they grew before, or who increases the value of vegetables or grains for feeding or other purposes twice what they were before? And so, too, is not the same rule applicable in its full force to the man who, by breeding, increases the value of stock of all kinds, perhaps fourfold? Now is there any doubt but that the pioneers of the Fairfield County Agricultural Society who are still living can see a marked improvement in all the various products of the soil, grains, etc., also stock of all kinds, as it appears to-day in comparison with their first exhibition, and exactly to the extent of this improvement has been their advance, so also can they undoubtedly see a vast increase in the amount of grains of all kinds harvested from a single acre, or the quantity of hay from an acre: but inasmuch as the man who enlarges his crop of hay has either done so by adding to the number of spires of grass, or by their increased size, then he "is a public benefactor," so, to the extent of the increase of all crops of every name and description, the people at large have been benefited.

Having thus prepared the way, it is proper to speak of the appearance of the exhibition.

The exhibition of the Fairfield County Agricultural Society was one that to a great degree tended to sustain the reputation of the society, and undoubtedly it may be as well to speak in general terms as to endeavor to particularize, since it is hardly best to occupy the space of our reports to mention individual entries, however gratifying the same might be to the exhibitor. The design rather of these reports should be, to make such suggestions as are calculated to advance the art of agriculture.

The amount of stock was not as great as might have been expected, but what was offered presented a fine appearance,

whether working oxen, blood stock, or milch cows. In fact, in some cases the cows were dry and carried too much flesh for reliable evidence of good milkers. Now it is hardly advisable to make special efforts to put a great amount of flesh upon an animal for the purposes of exhibition, hoping thereby to carry off a premium; but in the case of milch cows it would be far preferable, if all our agricultural societies would establish a rule that each entry should be accompanied by a statement of the quantity of milk given, and the quantity of butter or cheese manufactured therefrom, not forgetting to account for milk used in the family or otherwise. In this way, undoubtedly, some of the animals of high flesh with dry udders would stand in the back ground. The above was not the general rule at this fair, for there were many cows that presented the appearance of being good milkers, carrying at the time thoroughly filled udders. In the case of working oxen, some pairs appeared to have hardly borne the yoke at all, except as a means of training, much less to bear burdens; and as all workers of cattle well know, with high flesh they are not as capable of endurance as when continually worked and kept in moderate condition.

Although in this, as in all other departments, it is expected that the most beautiful specimens will be presented, would it not promote the *best* interests of agriculture to present good average specimens instead?

Of blood-stock there was a good show, and it would be an act of injustice to fail to mention the bull of Morris Ketchum, Esq., which is probably the finest bull of the Durham blood that can be found in our state; but in saying this it is no detraction from other blood-stock on exhibition.

Of sheep and swine, they were few in numbers; but this was not taken as an evidence that they were not raised in Fairfield County, but simply that there was a lack of interest in that department. Those that were on exhibition were *good* specimens, and there is little doubt that in this there was probably as near a good average representation as in any class unless poultry be excepted, which is not as susceptible of fancy preparation as some other classes.

The exhibition of horses was good; in fact much above many of the counties of our state, giving full proof that the people of the greater part of the county fully appreciate the merits of a good family- and carriage-horse; nor does their appreciation rest here, since it is evident that their pride in a good farm-horse is none the less.

Of farming implements there was a fair representation of apparently good specimens; but of these the proof is only in their use, and those that perform the labor required the most speedily, and at the same time in the best manner, will always be adjudged to be the best. And here it is proper to just direct attention to the improvements made in this department, which can be done by picturing in the imagination what tools were used by the farming community no longer than thirty years ago, and holding that picture in comparison with the implements of to-day. The only objection to such a course would be, that having done this, the inventors of those in modern use will claim for them a greater influence in the advancement of agriculture, than from improved modes of culture, which perhaps in some cases could be made with a reasonable show of justice. But while the exhibition contained implements for the saving of labor to the farmer, the farmer's wife was not entirely forgotten in the same line, as the washers, wringers, &c., fully attested.

The show of vegetables of all kinds was very extensive and could hardly be excelled, either in varieties or quality. The largest collections were from professional gardeners, rather than the general farmer, and though it is always pleasing to view so fine collections, the tendency perhaps would be to discourage less extensive cultivators in their efforts at competition. But since the attention of farmers of late is being turned more to the cultivation of root crops, it is desirable that the best systems of cultivation should be discovered, and then if these could be given to the committees to be incorporated into their reports, and perhaps printed in the sheet containing the awards of premiums and thus disseminated, much benefit would accrue. Nor is this all; the same rule applies to the cultivation of any crop. If the following of any

particular system results invariably in success, and superior crops, then so much information is gained, and as a matter of justice it should be the property of the whole farming community; and this can be done only by a careful record of all facts which furnish the data for a full written report of the system pursued, which being published, then becomes the property of all.

One very noticable feature in this department of the exhibition, was the show of the Bridgeport Copper and Sulphuric Acid Company, which consisted not only of samples of all of the materials of which their fertilizers were made, but also of specimens of different varieties of plant-growth as they appeared, both with and without the use of their fertilizer. Of the fairness of the samples presented, no person could have any means of judging; but if the conditions of growth with and without were the same and the results were fairly represented by these samples, then it was evident to any person that the fertilizer was something desirable. This much may be said, that if any company will put up a reliable article, it is much better for farmers to support such company if they are reasonable in their prices, than to purchase of distant and unreliable manufacturers with the risk of being defrauded.

It is particularly gratifying to learn that considerable attention is paid by the farmers of Fairfield County to the cultivation of root crops, since if these are fed upon the farm, it is thereby improved, for it needs no demonstration to prove that being so used, an increase of crops is the result, and that admits of an increase of stock, an increase of stock occasions an increase of manure, an increase of manure improves the fertility of the farm, and so in turn again occasions an increase of crops, and so the rotation may be continued until the highest possible degree of fertility is attained. The idea of thorough culture cannot be too strongly impressed upon the minds of farmers. It is far better to so arrange the labors of the farm, that what is done can be well done, rather than to attempt so much as to be, to use a common expression, driven by the work, rather than to drive that, which results invariably in imperfect and partially unsuccessful cultivation.

Any person having any doubts of the success of careful cultivation, had only to look at the different collections of vegetables presented at Norwalk, when they would at once be satisfied that the specimens were not the result of any careless cultivation; nor is it impossible to produce like results even from field culture, although it would of course require a no inconsiderable preparation of soil.

Another matter of interest in potato culture, was the exhibition of a large collection of seedlings, some of which exhibited marks of merit. This is the mode of obtaining new and valuable varieties, but what will be the effect upon the potato after continued cultivation remains to be seen. It is thought by some that in consequence of the special care given in the production of new varieties, the general character of the potato is so changed as to require constant care and nursing in its after culture, or else deteriorated potatoes will be the result; and as a proof of this is cited the case of the Early Rose, which is a very excellent potato, but with the same care and cultivation that was given to the ordinary kinds a few years ago, not only the crop but the quality is greatly reduced. If this should prove to be true, it will necessitate a change in the *production* of seedlings or in the *cultivation* of the general crop.

Passing to the department of fruits and flowers, we were very much gratified that notwithstanding the general impression of great scarcity of fruit, which is indeed true, we found a good collection of different varieties of apples and pears. Among the larger contributors could be seen the names of Stephen Hoyt & Sons, who presented twenty-one varieties of apples and fifty varieties of pears; Joseph Kellogg, who also exhibited twenty-one varieties of apples, and Charles E. Gregory fifteen varieties, all of which were good collections.

The collection of pears from the Messrs. Hoyt was very fine, which is not surprising when it is considered that this firm possesses an extensive nursery; and here we may perhaps be allowed to say that having had an opportunity of visiting these grounds, we were surprised at the luxuriance of growth of the young trees, as we observed some of two years

growth from the bud, which in size and beauty exceeded anything that we have ever seen in that line, and we do not wonderthat the farmers of Fairfield County have good fruit if they obtain their trees of this firm, which we trust they do, and which course cannot be too highly commended, since it is now generally conceded that fruit trees should be reared in a locality where the climate and soil are similar to that where they are intended to grow, resulting in healthy and fruitful trees.

The show of peaches was much better than is usually found at our county fairs. The show of grapes was also very fine, consisting of those of open culture and also those cultivated under glass, among the latter of which were some exceedingly fine bunches. There is undoubtedly more attention being paid to this particular branch of culture than there was a few years ago, which is not surprising when we take into consideration the great demand for this fruit, which is not only peculiarly palatable, but is by competent authority adjudged to be conducive to health. And while we are not ready to recommend the general cultivation of the grape for a purpose to which it can be put, viz., the making of wine, especially if the same is for improper use, we do believe that it cannot be too strongly urged that its cultivation be extended for table use.

Of flowers there was a good display, and it is always a pleasant thought that these are, to so use the expression, a part of the household. Very much of the dull monotony of the unadorned home surroundings can be relieved by the cultivation of only a small collection of flowers. Yea, more; very much of the dullness and dreariness of winter can be dissipated by the addition of a collection of pot-plants within doors, which, after all outward foliage has been destroyed, and when the snows of winter overspread the face of the earth, render all within cheerful and life-like. Where scenes like these prevail, there does not exist that hatred of the old farm-home which is often complained of and which results in the departure of the younger members of the family in search of more congenial conditions. We hope that the wisdom of the farmers of Fairfield County induces the pursuit of such a

course as does, and always will, prevent such a state of affairs.

Of butter, cheese, bread, honey, and canned fruits, there was a good show, which spoke well for the skill of the ladies in the manufacture of those articles, the latter of which has now come to be one of the necessities of the table.

The departments of arts and fine-arts, and domestic manufactures, &c., were well filled, and bore unmistakable evidence of the untiring industry of those who wrought the many useful and beautiful articles which were to be noticed. While we all should be admirers of proficiency in the many ornamental accomplishments which add so much to the social aspect of society, and would at all times urge education in that direction when not conflicting with the more useful accomplishments, at the same time the former should never be cultivated at the expense or neglect of the latter; that is, all young ladies should be educated in the necessary duties of the household in its various departments, and when so educated there need be no danger of a scarcity of articles in the ladies' industrial departments of our fairs. On the whole, as a summing up of the results of our observations, we feel compelled to say that with the exhibition as presented, and the apparent interest felt by all, the Farmers of Fairfield County need have no fears for the success of their society.

In conclusion we wish to extend our thanks to the many and different individuals for their courtesies and kind attentions, and untiring efforts to add to the pleasure of our visit to their fair.

WILLIAM H. YEOMANS,
Delegate to Fairfield County.

WINDHAM COUNTY.

Having attended to the duties of my appointment, I have the honor and pleasure to report a very agreeable visit to the Windham County Cattle Show and Exhibition, held on the grounds of the Society, September 26th, 27th, and 28th, 1871.

This Society owns the land, and buildings thereon, upon which it holds its annual fairs. It is endowed with a permanent fund, has a good half mile track, and a large building for the display of articles which require shelter, also pens for the various classes of live stock. The Society has expended about $7,000 in land and fixtures, and is free from debt.

The Fair was quite successful and well managed, and the articles on exhibition were in great variety and of excellent quality. The fruit was very fine for so unpropitious a season as the last was. In the dairy products, it excelled, as Windham County always does, and the display of grain and vegetables, general and domestic manufactures, and farm implements, was creditable. Also, in the department of domestic animals, the exhibition exceeded what we expected to find. The working oxen showed good breeding and careful training, and the cows good milking qualities. Not to particularize further, in this line we must say that our friend Day, of the Board of Agriculture, had the best pen of pigs of their age we ever saw.

The plowing match was quite a feature in itself, and was sharply contested by from 12 to 15 teams.

Some idea may be formed of the extent of the exhibition by the number of entries taken from the list, and this number does not cover it, for a single entry often included several articles or animals. In the class including cheese, butter, bread, vegetables and grain, 191 entries; carriages, boots and shoes, and plowing, 49; miscellaneous articles, painting, etc., 95; cattle, sheep, and swine, 167; manufactures, 140; horses, 83; fruit and flowers, 137.

We were much pleased with the evident interest all classes seemed to take in the Fair. Not only the manufacturer with his goods, the farmer with his products, and the laborer released from his toil, were present, but there was a full representation of their families gathered to enjoy a holiday.

Thomas A. Mead, of Greenwich, member of the Board for Fairfield County, also visited this Fair, neither of us having been able to visit the Fair of the Woodstock Society, held the week before. But from what we heard of the doings of that

Society, and saw of its members and their contributions to this exhibition, we are sure they have a live Society that is doing much good in that locality in the interests of an improved agriculture.

In conclusion, we are happy to acknowledge the generous hospitality of the Society, and its officers and members, and the courtesy of Col. Williams, Chief Marshal, which contributed much to the pleasure of our visit.

NATHAN HART.
Delegate to Windham County.

LITCHFIELD COUNTY.

It having fallen to my lot, fortunately, to attend some of the exhibitions of Agricultural Societies in Litchfield County, I had an opportunity of passing up the Naugatuck and Housatonic valleys, and certainly there can be few rides found in any country affording more interesting and beautiful scenery than either of them.

To the business man, there is presented water power of an almost unlimited extent, with the best facilities for building: to those who have an eye for the beauties of scenery, every moment presents something to delight and call forth exclamations of surprise and admiration.

A turn in the stream will now present some new and beautiful view, or it will take a leap over some obstructing rock, or play in a variety of moods over some meadow. Mountains of no mean dimensions and ever altering shapes and forms keep coming into view, and not infrequently cosy little dwellings nestling in the valleys or stuck into the hills, so now and then will be seen small shops beside the streams, giving unmistakable signs of "Yankee Notions," showing that ingenious heads and fertile brains are at work catering to the demands of wealth, and bringing back to these rugged hills a share of it.

The agriculturist finds more to attract his attention along the Housatonic road than the other. It runs through a more fertile and extended valley, though it by no means embraces all the fat of the land. The rich pasture lands of Newtown lie on the west, but in New Milford we see some good farms and good farm buildings, yet we miss the fine barns with their conven-

ient arrangement, we see in eastern Connecticut. In Kent, we see some fine fields of tobacco and hear of more, but *do not* see the fruit trees and vines so plentiful as we should expect in so sheltered and suitable a place.

But when we reach the upper part of the county and leave the railroad, we are more than delighted with what we see.

Salisbury with its fertile and beautiful farms, and mines of iron almost unequaled for quality by any in the world, the towns of Sharon and Canaan, each has more beauties of scenery, cultivation, and thrift than we can mention. The farms are small but highly cultivated, their houses neatly painted, with blinds of green to cover the windows, a door-yard fence that encloses a yard filled with shrubbery, and everywhere we see unmistakable signs of enterprise and a *manly independence* of character.

There is little rotation of crops, and no prominent article of produce unless it is milk. The Harlem Road on the west affords an outlet for their milk and carries a large quantity to New York markets. The Housatonic Railroad enjoys the largest share of the transport of milk from the county, but the Naugatuck on the east also runs a successful milk train. West Cornwall, the largest milk station on the Housatonic R. R., shipped for New York, in 1871–2, 3,371 cans, of 40 quarts each, amounting to 934,840 quarts. There is considerable attention given to raising nursery fruit, for which the soil is peculiarly fitted.

When we leave the Naugatuck Railroad and mount the hill which rises some hundred feet before coming to Litchfield, we have a very different view. There are few villages which can compare with it for freshness and airy beauty in summer. It is a charming place in the warm season. I have never been there in winter and cannot say how it is, but it looks as though it would be as cold and dreary at that season as it is charming and lovely in summer.

As an agricultural town, it has a fine appearance as respects grass, but looks too cold for grain and general cultivation, and too exposed for fruit.

Stock raising seems to be one of the chief employments, and few towns in the State excel its farmers in this line.

This county is emphatically the home of the Devon in Connecticut. The Messrs. S. & L. Hurlbut, of Winchester, commenced breeding the Devon in 1819, and the excellence and high esteem in which their stock was held is attested by the fact that some of the best representatives of this breed in New England are traced directly to them. Later, others took it up, and not the least worthy of these breeders of the Devon is that veteran farmer, Jacob N. Blakesley, of Watertown, now more than four score years of age, who has many animals finely bred and of rare beauty and value.

There is little stir and enterprise manifest in Litchfield, but much satisfaction and content. It has but little water power, but, by the recent opening of the Shepaug Valley and Connecticut Western Railroads, its facilities for market, and easy communications with other parts of the country have been greatly increased.

The Exhibition of the Litchfield County Agricultural Society commenced on the 4th day of October, and it was one of those loveliest days in autumn when the rugged hills and valleys were decked in their varied and beautiful colors.

I arrived upon the grounds a little after one o'clock, and too late to witness some of the most interesting features of the exhibition.

My attention was first called to the working oxen, of which there was a large and very fine show, mostly Devons and their grades. Here we saw teams of from five to eight or ten pairs, with the mature pair of six years old in the rear, and younger ones, of all ages to the yearling, on the lead. Most of them were raised by the exhibitor, a feature of great merit and commendable at an Agricultural Fair.

The oxen and steers were well broken, ready to do their masters' bidding, which was unattended by the shouting and whipping so useless and censurable at any time. A number of pairs of them were as valuable as the best I have seen at our New England Fairs.

In herds of cattle, the exhibition was excellent and the com-

petition close. Some of the exhibitors of these were three score years and ten and more, yet they had the enthusiasm and love of their calling seen in men in the prime and vigor of manhood.

E. L. Thompson, Chandler Judd, Stanley Griswold, and Jacob N. Blakesley, with others, were out in full force with herds of their own raising, numbering from eighteen to thirty-six head, and many of them excellently and finely bred cattle.

The show of thorough bred and grade bulls was creditable to the Society, but few were of that high character that I expected to have seen.

The cows, heifers, and calves of the Ayrshire, Devon, and Alderney breeds, were in good numbers, and embraced many valuable and well bred animals in all of their classes.

Of sheep, the show was good and quite extensive.

Of swine, small and of no particular merit.

The "hen fever" seems to have abated in this county, consequently the "biddies," ducks, geese, etc., were not in great numbers, but some of the *fancies* were of good quality.

I was somewhat disappointed in the show of horses.

A horse show at Wolcottville, occurring at the same time, was given as the reason for the lack in this particular. I was assured, however, that there were as fine and valuable horses bred in this county as in any part of the State. The trotting was in good time, gentlemanly and quietly done, affording much pleasure to lovers of this part of an exhibition.

There was a fair show of farm implements, sewing machines, etc.

The dairy products, vegetables and fruit, domestic manufactures, flowers, etc., were shown under the Society's tent, and made a good display, and were of excellent quality. T. S. Gold, Esq., showed twenty varieties of the new and popular kinds of potatoes, the worth of some of which is to be established by future cultivation.

The display of flowers was worthy of more than a passing notice, but where all have done so well it is difficult to particularize.

His Excellency, Governor Jewell, was the guest of Hon. Charles B. Andrews, and attended the Fair on the last day.

The Thomaston Brass Band escorted His Excellency to the fair grounds, and were in attendance during the Show; "and all the time sonorous metal blowing martial sounds" discoursed sweet music.

The annual address by T. S. Gold, Secretary of the Connecticut Board of Agriculture, was thoroughly practical, full of instruction, and was well received. His Excellency made a few well-timed remarks, and thus closed an Exhibition profitable and pleasant to all.

It was one of the best managed Fairs that it has been my privilege to attend, and the officers of the Society and citizens gave me a hearty welcome to their hospitalities, and treated me with unaffected politeness.

The Cattle Show and Fair at Falls Village, Canaan, took place on Tuesday, Wednesday, and Thursday, the 12th, 13th, and 14th of September.

Their enclosure is in a valley of unsurpassed beauty, and peculiar to this part of the state, and is bounded on one side by the Housatonic river.

The first day was pleasant, and there was a good attendance of interested spectators, and the stock of cattle fully equal in numbers and quality with former shows. The exhibition of working oxen was quite good. T. S. Gold, of Cornwall, had four pairs of strong, well-matched oxen, all raised by himself. There were a number of others of excellent merit. There seemed to be a lack of premiums offered for their general exhibition, so that your Delegate could not judge so correctly of their merits as he would have wished to. The only test I saw was at a heavily loaded stone-boat, where three yoke of them showed wonderful physical power, and attracted much attention. The test was too severe, and much more than was necessary to have formed a right opinion of their training and value. The whipping and shouting was unnecessary, and should be discontinued in future.

The bows in the yoke were nicely fitted to the neck of the ox, with staples beside each bow, to which a breeching was attached to assist in holding loads down the steep hill-sides.

There was a good show of cows and heifers. Sheep, though not in great numbers, were of good quality. Of swine, there were some nice specimens, and worthy of commendation.

Milo B. Richardson, of Salisbury, showed one of the best, most valuable, and finest bred Short-horn bulls that it has ever been my pleasure to have seen, and I have no doubt but that his worth will be appreciated by the farmers in this part of the county. A cross by him with the Devon or native breeds of cows cannot fail to be productive of the best results in the increased size and milking qualities of their offspring. The bulls owned by Robbins Battell and William Barnum were excellent representatives of their class, and valuable animals.

Horses were in respectable numbers, of fair merit, but not equal to what the good farmers with the facilities they have at hand should raise. A valuable animal is always a pleasure for service, to look upon, and of no more cost to the owner than the indifferent and poor one.

The trotting was well managed, spirited, exciting as it always does the admiration of ladies and gentlemen. The horses were driven by those evidently having the character of gentlemen.

The third day was wholly devoted to horses, but your Delegate was obliged from the pressure of business to decline an invitation to be present.

The Hall was well filled with vegetables of all kinds—cabbages, beets, turnips, &c., large enough. Yellow pumpkins and squashes in close proximity with the new patterns of cooking-stoves were very suggestive of that time-honored festival, Thanksgiving—and made us hope that some one would extend an invitation to us to pass that day in this part of the State.

Fruit was not in great abundance, owing to the light crop. I noticed some good apples and pears that were inviting and of choice new varieties, showing the progress and taste of the cultivators of them.

In grapes there was a good display of the hardy varieties, but it was too early in the season to have them well ripened.

The flowers were tastefully arranged, beautiful to look upon, and admired by lovers of the beautiful.

There were numerous articles of worsted embroidered work, bed-quilts, rugs, and rolls of rag-carpeting, of neat patterns, well made and useful, and some of them by ladies of an advanced age.

The butter and cheese were worthy of the reputation of the county.

The honey was inviting; and the wine, of which there were ten samples, was tempting. A committee of the society pronounced it *good*, and a number of other committees, self-appointed, agreed with them in judgment.

The rain on the second day of the exhibition was unfavorable for a large attendance, but the show was a fair success, and worthy of the enterprise of its energetic officers and members.

The address was by T. S. Gold, Secretary of the Connecticut Board of Agriculture; subject, "The changes of the passing century." No comments need be made upon it, but to recommend its publication for the benefit of the community.

Your Delegate was courteously received by all, and had the pleasure of enjoying the hospitalities of the President of the society, Robert Little, Esq., at his home in Salisbury, and of viewing his large, excellent, and well cultivated farm.

ALBERT DAY,
Delegate to Litchfield County.

VALLEY PARK ASSOCIATION.

By request of Messrs. Hyde and Day, I visited the annual fair of the Valley Park Association, held at Wolcottville on the 11th and 12th days of October.

The morning of the 11th opened with a heavy rain storm, which continued till midday, followed by northwest squalls and occasional flakes of snow and rain. It was two o'clock before the Secretary had completed his entries.

There were between forty and fifty yokes of oxen and steers of very fair quality; a pair of Durham three years old steers from the town of Litchfield, which stood quietly unyoked and

were driven with the same ease and precision as though they were yoked.

About thirty-five cows and young stock were on exhibition, making a very fair representation of Devons and their crosses with other breeds; also a very good flock of Cotswold sheep.

The 12th, the day for horses, opened very windy and blustering; very few horses were exhibited, and the trials for speed for large and small purses were given up.

In the Hall there was a very good exhibition of fruit and vegetables, consisting of ninety parcels of apples, many of them having their origin in the town of Torrington and vicinity, and worthy of more extensive propagation; between twenty and thirty samples of pears, very fine, as usual this year, and a number of plates of grapes, and a variety of potatoes, turnips, pumpkins, &c.

Grain of various kinds was shown, and butter and cheese to a small extent.

The exhibition of domestic and fancy work by the ladies was very fair.

Case & Co. made a good show of their rolled brass and wire, from the size of a fine thread to one-quarter of an inch in diameter. Other manufacturers made a fine display of their goods.

I left Wolcottville fully impressed with the idea, that, had the weather been fair, their exhibition would have vied with many of our county fairs.

THOMAS A. MEAD.

MIDDLESEX COUNTY.

As delegate from the State Board of Agriculture to visit the Fair of the Middlesex County Agricultural Society, held in Middletown, Sept. 26–29, 1871, I would respectfully report, that, in consequence of business engagements, I was compelled to make my visit on the last day, (Friday,) which I deeply regretted, as I had a great desire to see "those wonderful cattle that came from the Portland quarries."

The Society labored under, what appeared to me, a great

disadvantage of having this exhibition divided, part being held in McDonough's Hall and the rest on Griffin's Park, about a mile and a half from the hall. It is to be hoped that next year the fair will be held at one place, as I understand that it is the intention of the Society, as such an arrangement would most certainly prove beneficial, in financial results if no other.

The exhibition of trains of working oxen took place on Thursday, the 26th, and was not as large, so I was informed, as on former years. About one hundred yoke appeared on the ground, fifty-one of which came from the town of Portland. They, as well as the trains from the other towns, were accompanied by tastefully decorated carts. I regret that a more detailed account of this part of the exhibition cannot be given. The display of cattle (other than working), horses, sheep, &c., on the park was not what I expected to find. About thirty head of all grades of cattle were shown, a few of which were meritorious animals. Mr. M. W. Terrill, of Middlefield, was the only large exhibitor, having some fine looking animals of the Durham breed.

The display of horses was large, there being seventy entries, among them some really fine looking animals; but as they were constantly being driven around the track I had no opportunity to make an examination.

The show of sheep and swine was very small. But one pen was filled with the former, a highly gratifying report for a county which contains within its borders some of the finest sheep in the state. The swine exhibited were mostly of the Berkshire breed, and were all fine. I trust I may be pardoned if I suggest the improvement, that hereafter the swine be placed in the pens provided for them, and thus visitors will not be compelled to climb on top of farm wagons and ox-carts in order that they may get a peep through slats set half an inch apart at animals exhibited for public inspection.

The show of poultry was large and fine, Buff Cochins taking the lead, Brahmas next, and the remainder about equally divided between fowls of different breeds, turkeys, geese, pigeons, &c.

The exhibition of vegetables, fruits, &c., at the hall, though not very extensive, was good. The vegetables were all fine, especially the display of potatoes, beets, and turnips. Of the fruit, the apples were the best I have seen this year, and were shown almost wholly in half-bushel baskets. The display of pears and grapes, also flowers, was small, though many very creditable specimens were on exhibition.

Middlesex county has some good, yes, very good butter makers, as was fully attested by the fifteen samples on exhibition. Cheese making, judging from the exhibition made, does not receive attention from the farmers of old Middlesex, but two samples being shown.

The department of fancy and manufactured articles was well fitted and reflected much credit upon the exhibitors.

WM. H. POND,
Delegate to Middlesex County.

TOLLAND COUNTY.

As a Delegate from the State Board of Agriculture to visit the Tolland County Fair for 1871, I would respectfully report:

It is a matter of regret to me that so many of the agricultural fairs of our state were held on the same days. Windham, New London, and Tolland, adjoining counties, (without mentioning others,) each held their annual fair the same days; thus precluding friendly visiting and interchange of ideas and experience, which are as necessary to the happiness and prosperity of farmers as they are to any class of men, either mechanics, manufacturers, or professional men. Being an officer in the Windham County Society, I was delayed in my visit to Tolland County, and was only present a part of the last day of the fair.

This, the nineteenth annual exhibition of Tolland County Agricultural Society, was held at Hyde Park, near the flourishing and enterprising village of Rockville, on Wednesday

and Thursday, September 27th and 28th. I arrived on the ground on Thursday, about 11 o'clock, A. M. The neat stock was all withdrawn at the close of the first day, and consequently I missed seeing the cattle. I was told that entries in this department were not as large as on some former occasions.

Of sheep and swine, there were but six entries, and consequently but few on the ground. So far as swine are concerned, it is not to be wondered at, as they are at a discount with almost every farmer at present; but sheep, at the present prices of lamb, mutton, and wool, are the most profitable stock (and are likely to remain so,) that a farmer can invest in, and especially adapted to the light and dry lands of Tolland county. A small flock of sheep, well kept and cared for, are sure to make a handsome return if early lambs are raised for market, as they are an article that will not bear transportation from the far West.

There were a few coops of good poultry on the ground. This is a branch of farming deserving of increased attention. Many farmers that have depended upon the money for their pork to pay rent or interest, will this year rely upon their turkeys. The consumption of eggs is enormous, and they always bring remunerative prices.

No farming utensils of any kind were observed on the ground.

On entering the building, my attention was first directed to the fruit department. The show of apples was good for the season. Grapes and pears were excellent, though the display was not extensive. Then, near at hand, were two plates of peaches that looked tempting; canned fruits, jellies, quinces and cranberries. There were shown specimens of corn in the ear; also, potatoes of the leading varieties, root crops, squashes, pumpkins, &c. In short, the show of produce of field and garden was excellent. Porter Walbridge of Tolland, the largest exhibitor, showed over forty varieties of produce. There was a good display of butter; the show of cheese was small.

Still further, on the ground floor of the building, were sev-

eral stylish buggies and carriages from the establishments of Wm. D. West, and Banning & Southern, of Rockville. They were of superior workmanship and finish, and could not fail to suit the most fastidious.

The upper floor of the building was devoted mainly to domestic and fancy articles, of which there was a good exhibition; and on Thursday the throng of visitors to this room was very numerous. There was a fine display of fancy cassimeres by the American Mills, Hockanum, and New England Company; ginghams by the White Manufacturing Company, and many other articles by other parties which I am not able to enumerate, all of which contributed greatly to make the fair attractive and interesting.

The Coventry Brass Band was in attendance Thursday, and gave variety by the fine music they discoursed.

Thursday outside of the building was devoted to horses, and in that part which came under my observation, of gentlemen's driving horses, double and single, there were twenty-five entries, and many fine animals appeared on the track and were admired by the crowd in attendance.

The programme for the day was closed by a call for outlandish turnouts. There were two entries; both answered to the call, and if I may be accounted a good judge, I think Tolland county has taken the lead in this class. A few drops of rain from a threatening sky hastened the steps of the crowd homeward, and thus ended the Nineteenth Annual Fair; and, judging from the attendance, it was highly satisfactory to the officers of the society, financially.

In conclusion, I would say that the season just closing is remarkable that, in this vicinity, there has not been a failure in a single crop with the exception of apples. Corn and potatoes are excellent, and all other crops will give an average yield. And furthermore, that Tolland County is well adapted to mixed farming by reason of the ready market near at hand. Vegetables of all kinds, the smaller fruits, the produce of the herd and the flock, and especially hay and straw, will always meet with a ready sale. If the farmers of Tolland County could understand their advantages by reason of the locality

in which they are situated, and would awake to renewed diligence and energy in their calling, and would seek to make improvements in farming, as are being made in other branches of business, they could increase the exhibition just closed in all its departments an hundred fold, in 1872.

I saw but little of the officers of the society during the short time I was present. I wish to extend my thanks to W. H. Yeomans, Esq., one of the Vice-Presidents, for courtesies shown, and also to J. A. Spalding, Esq., of the Tolland County Journal.

GEORGE SANGER,

Delegate to Tolland County.

TOLLAND COUNTY, EAST.

Tolland County East Agricultural Society, the youngest organized society in our state, has already placed itself in a high position, so far as agricultural exhibitions are concerned; and although the portion of Tolland county of which this society is composed, presents as rough an exterior as can be found in the county and also in the state, from which we should hardly expect to find an average exhibition, we are happy to state that this offspring from the old county society shows unmistakable signs of smartness that are no doubt gratifying to its founders, which proves that it is not wholly a degenerate child. The pluck of this society was fully tested in this, the second annual exhibition, when on the day appointed for the same, the heavens were overcast with clouds from which poured the descending rain, whereby the show was prevented and thus postponed, the very natural effect of which was discouraging; but such an effect could not be discovered here, for on the day appointed the streets in all directions were filled with people whose countenances revealed a determination of still making their show worthy of the young society. To speak in general terms, all departments of the fair were well represented.

The show of stock, all things considered, was much larger than might have been expected, consisting of blood stock of

different kinds, milch cows, and working oxen, with town trains from the towns of Stafford and Willington, from the former of which were fifty-five pairs, and from the latter thirty-five pairs, and if among these could be found those of the class of which we have *read*, in which one was *said* to be good and the other unworthy, the former of which *appeared* to be ashamed of his mate, then we should think the people of Tolland county, whether the old society or the East, would be proud that they possess that kind of stock. A very interesting exhibition of trained oxen was made by Messrs. George W. Converse, of East Longmeadow, and T. B. Walker, of North Coventry, in which it was manifest that the cattle had passed through a careful course of training and were perfectly under control. Lieut. Gov. Hyde, the active president of the society, had a herd of twenty-five animals of Devon blood of various ages, which added very much to the show, and which cannot be excelled even in all New England. Mr. Hyde is a pioneer in the introduction of blood stock into this county, and is deserving of a great amount of gratitude for the healthy influence which has in consequence thereof been exerted upon breeders of stock. Ayrshire stock was also exhibited by Chauncey Smith, Esq., which attracted deserved attention. There was also noticed a bull of the Dutch stock which was an object of attraction.

Of horses there were a number of fine animals, but as this society had not at that time any grounds convenient, the trotting was not made as much of a specialty of their show as it otherwise would have been. We are pleased to learn however that since the show, grounds have been purchased just west of the Springs village, where all the conveniences of a fair ground are to be erected; but while we would recommend the encouragement of the horse, so far as the necessities of the farm or carriage demand, we would not advise the pursuing such a course as that the horse should swallow the agricultural interests of the society.

Of sheep, swine, and poultry, there was a good show though somewhat limited as to numbers, and after a careful examination of the sheep, more especially of the fleeces upon

their backs, we could discover nothing that would preclude the impression that the Cassimeres and other cloths manufactured and on exhibition were manufactured from the *same kind of wool*. And so too of the poultry; if there is any probability that what was on exhibition came from the bushes of the territory comprising Tolland county East, then it is far superior and above other sections of our state as to its ability to furnish valuable game.

The collection of produce was excellent and extensive, and we noticed one exhibitor, Mr. E. W. Upham, of Union, who had a collection of fifty varieties of produce, which, we believe, could not be beaten in the whole state; in this collection there was a very pretty arrangement of beans, consisting of twenty-four varieties. Rev. G. V. Maxham also had a collection of twenty varieties of produce, which is very creditable when it is known that all were grown upon a small surface of ground by the careful attention of the cultivator. And though Mr. Hyde was so thoroughly represented in the class of blood stock, he was not found wanting in the class of produce, as we noticed a collection of seventeen varieties of potatoes, among which was to be found Hyde's Seedling, which is a new potato of great promise. There were many others in this department who were extensive exhibitors.

The show of apples was necessarily very small, but the specimens that were presented were of good size and apparently of good quality. The show of pears was good; ten varieties were shown by Mr. Hyde, who was the most extensive exhibitor.

The show of butter, cheese, and bread of the different kinds was very fine and extensive, and we doubt not but that the evidence of the palate would have been such as to fully prove the actual excellence of the specimens.

Some very fine specimens of butter from the Devon stock of Lieut. Gov. Hyde were presented by Mrs. Hyde, and were well deserving the report of the committee.

The Ladies' Industrial Department was very well filled with articles both ornamental and useful, and wherever this condition of things exists, it is certain evidence that the

ladies themselves are deeply interested in the fair, and wherever they are interested, it has its due influence upon the sterner sex, and it was very certain from viewing the entries, that the interest felt by Gov. Hyde was not wanting in other members of his family.

Another fact was particularly noticeable, and that was the interest felt by the merchants and tradesmen of Stafford Springs, which induced them to fill the hall with the various articles of their sales, whereby the same are brought to notice and thus thoroughly advertised. So, throughout every department of the exhibition there was evidence of a deep interest in the prosperity and welfare of the society, which was sufficient to warrant the prediction that, though still in its infancy, it will, as it increases in years, grow in strength and popularity, until it occupies a position second to none among kindred associations.

At twelve o'clock of the day of the Fair an address was delivered by the President, Lieut. Gov. Hyde, in which, as might have been expected, were contained very many valuable practical suggestions, which should receive the careful consideration of the audience. And here we may be permitted to suggest that the annual address should become one of the permanent things to be found in all of our fairs.

We feel that we should be doing injustice should we fail to express our thanks to Mr. Hyde and family for their efforts to make our visit pleasant.

WILLIAM H. YEOMANS.

Delegate to Tolland County, East.

J. S. ALLEN, TREASURER, IN ACCOUNT WITH STATE BOARD OF AGRICULTURE.

Received from the Treasurer of the State, Jan., 1872,			$2,500.00
	PAID.		
Jan. 11th, 1872,	W. H. Yeomans,		$32.00
	Nathan Hart,		55.61
	John Brewster,		15.00
	Wm. H. Pond,		16.85
Jan. 18th,	Albert Day,		47.60
	Geo. Sanger,		25.40
Jan. 23d,	T. S. Gold, Bill, Salary and Expenses,	$307.84	
	Printing and Stationery,	37.23	
	Postage,	21.39	
	Express,	28.68	
	Danielsonville Meeting,	134.75	
	Sundries,	25.00	
		$554.89	554.39
Feb. 1st,	J. T. Rockwell,		16.00
Feb. 12th,	H. L. Stewart,		29.29
Apr. 12th,	J. M. W. Terrington,		230.25
	T. S. Gold, Bill, Salary and Expenses,	$418.76	
	Postage,	5.76	
	Express,	4.00	
	Sundries,	1.82	
		430.34	430.34
Apr. 12th,	J. S. Allen,		60.00
May 29th,	T. A. Mead,		24.20
"	Dr. Alfred Large,		25.00
"	E. H. Hyde,		100.73
"	Dr. N. Cressy,		301.50
			1,964.16

RETURNS OF AGRICULTURAL SOCIETIES FOR 1871.—Finances.

SOCIETIES.	Amount received from State.	Memberships and Admittance fees.	Donations.	All other sources.	Receipts for the year.	Premiums offered.	Premiums and Gratuities awarded.	Premiums and Gratuities paid.	Current expenses for the year, not including premiums and gratuities.	Disbursements for the year.	Indebtedness.	Value of Real Estate.	Value of Personal Property.
*Hartford, - -													
*New Haven,													
New London, -	$300.00	$1,720.47		$461.00	$2,481.47	$1,564.75	$1,148.50	$1,034.50	$548.74	$2,312.09	$5,664.00	$8,000.00	
Fairfield, -	200.00	3,347.97	$77.50	778.50	4,490.64	2,500.00		1,410.00	1,331.74	4,490.64	9,500.00	18,000.00	$250.00
Windham, -	200.00	1,195.00		125.00	1,320.00	1,457.75							
Litchfield, -	200.00	748.00	15.00	72.00	1,020.00	1,196.00		903.00	160.00	1,004.00		1,500.00	400.00
Middlesex, -	300.00	1,303.87			1,618.87	885.00	511.75	480.00	686.12	2,028.74		850.00	400.00
Tolland, -	200.00	288.81		699.11	987.92	691.50	549.00	549.00		987.92	1,250.00	2,000.00	50.00
Pequobuck, -		282.50	15.00			381.75	272.00	126.60	185.15	311.15			
Woodbury, -	100.00	514,43		173.65	788.08	636.75	450.25	265.30	478.20	743.50	210.00	†937.00	
Housatonic, New Milford,	100.00	1,000.00			1,100.00	750.00	590.65	584.45	592.02	1,174.47			950.00
Watertown, -	100.00	1,037.13		312.00	1,449.00			964.00	257.39	1,221.39			900.00
Danbury, -	100.00	3,193.30		‡7,658.73	10,952.03	1,430.00	1,246.25	1,233.25	1,150.40	§10,373.38		7,381.00	
Ridgefield, -	100.00	1,939.70		124.00	2,163.70	1,248.50	986.45	967.95	1,388.41	2,350.86	360.00	3,000.00	500.00
Tolland County, East, -	100.00	404.83	269.65	63.50	837.98	400.00		342.15	181.77	523.92			314.06
Milford, - *Orange, -	100.00	447.00	3.00	75.00	622.00	590.50	282.09	282.09	271.73	542.23			350.00
Oxford, -	100.00	117.77	5.56		223.33	237.50		164.25	63.25	228.00			
Bethany, -	‖	453.63	5.00	100.00	558.63	284.00			255.00	539.00			

* No Fair. † Real and Personal Estate. ‡ Including Stock Subscriptions. § Including Lands Purchased. ‖ Returns too late.

AGRICULTURAL SOCIETIES IN CONNECTICUT, AND OFFICERS FOR 1871.

	PRESIDENT.		SECRETARY.	
Connecticut State Agricultural Society,	E. H. Hyde,	Stafford.	T. S. Gold,	West Cornwall.
Hartford County " "	S. M. Wells,	Wethersfield.	Warren Rowley,	Hartford.
New Haven County " "	J. J. Webb,	Hamden.	W. Webb,	New Haven.
New London County " "	I. B. Barstow,	Norwich.	P. B. Greene,	Norwich.
Fairfield County " "	J. Camp,	Norwalk.	C. E. Plumb,	Trumbull.
Windham County " "	J. D. Bates,	Danielsonville.	George Sanger,	Canterbury.
Litchfield County " "	Nathan Hart,	West Cornwall.	S. Johnson,	Litchfield.
Middlesex County " "	J. M. Hubbard,	Middletown.	E. Rockwell,	Middletown.
Tolland County " "	C. Underwood,	Tolland.	G. H. Kingsbury,	Rockville.
Pequabuck, Bristol, - - - - -	Abijah Catlin,	Harwinton.	N. L. Brewster,	Bristol.
Milford and Orange, - - - -	Charles F. Smith,	Milford.	George F. Platt,	Milford.
Oxford, - - - - - - - -	Joel White,	Oxford.	R. S. Hinman,	Riverside.
Bethany and Woodbridge, - - -	D. W. Clark,		S. G. Davidson,	Bethany.
Farmers and Mechanics, Guilford, - -	Henry Fowler,	Guilford.	John S. Elliott,	Guilford.
Union, Wallingford, - - - -	Henry L. Hall,	Wallingford.	B. T. Jones,	Wallingford.
Danbury, - - - - - - - -	J. F. Beard,	Danbury.	T. G. Wildman,	Danbury.
Ridgefield, - - - - - - -	E. H. Smith,	Ridgefield.	B. K. Northrop,	Ridgefield.
Woodstock, - - - - - - -	O. H. Perry,	Woodstock.	John Dimon,	Putnam.
Housatonic, New Milford, - - - -	H. W. Booth,	New Milford.	W. J. Starr,	New Milford.
Union, Falls village, - - - - -	Robert Little,	Falls Village.	C. E. Baldwin,	West Cornwall.
Woodbury, - - - - - - -	D. S. Lemmon,	Woodbury.	W. O. Strong,	Woodbury.
Watertown, - - - - - - -	O. B. King,	Watertown.	C. T. Hickox,	Watertown.
Valley Park, Wolcottville, - - -	H. J. Allen,	Wolcotville.	C. F. Church,	Wolcottville.
Tolland County, East, - - - -	E. H. Hyde,	Stafford.	E. O. Dimock,	Stafford Springs.
Conn. Poultry Society, - - - -	S. J. Bestor,	Hartford.	W. H. Lockwood,	Hartford.

NUMBER OF ANIMALS EXHIBITED.

SOCIETIES.	Bulls.	Milch Cows.	Heifers.	Calves.	Working Oxen.	Steers.	Fat Cattle.	Horses.	Sheep.	Swine.	Poultry.	All other Stock.
Hartford,*												
New Haven,*												
New London,												
Fairfield,	16	4	8	6	40	4	8	144	27	25	82‡	8
Windham,												
Litchfield,	32	40	36	28	110	88	18	42	70	1	63	
Middlesex,	11	35		11	225		9		4	24	115	
Tolland,	11	40	8	10	128	20	6	30	6	12	25	
Pequabuck,	5	2	3	2								
Woodbury,	18	23	24	4	34	50	4	61	6	5	20	
Housatonic, New Milford,	5	30	14	8	120	12	12	66	32	2	12	
Watertown,	18	74†			24	26	9	40	31	6		
Danbury,	11	23	9	3	68	28	7	82	31	9	55	8
Ridgefield,												
Tolland Co., East,												
Milford and Orange,	4	15	7	4	302		5	35	25	28	54	
Oxford,	1	3			32	12	4	36	3		2	
Bethany,	7	10			26	2	16	19	2		28	

* No Fairs. † Cows, Heifers, and Calves. ‡ Coops.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

FOR FARM STOCK.

SOCIETIES.	For Bulls.	For Milch Cows.	For Heifers.	For Calves.	For Working Oxen.	For Steers.	For Fat Cattle.	For Horses.	For Sheep.	For Swine.	For Poultry.	All other Stock.	Total amount offered for Live Stock.	Total amount awarded for Live Stock.	Total amount paid for Live Stock.
Hartford,*															
New Haven,*															
New London,	$68.00	158.00	36.50	32.75	60.00	23.00	6.00	458.00	82.00	30.00	8.00		1,218.25	962.25	866.00
Fairfield,	72.00	40.00	36.00	13.00	72.00	9.00	13.00	425.00	80.00	40.00	100.00	10.00	1,493.00	925.00	
Windham,	98.00	52.00	56.00	18.00	109.00	36.00	17.00	158.00	59.00	26.00	11.00		860.00	640.00	640.00
Litchfield,													840.00	594.00	583.00
Middlesex,	17.00	37.00		4.75	66.00		21.00		6.00		30.00		400.00	179.75	173.75
Tolland,	8.00	23.00	16.00	6.00	78.00			195.00	2.00	8.00	7.00		495.00	343.00	343.00
Pequabuck, Bristol,	9.00	4.00	3.00	2.00	64.00	9.00		25.00	5.00		6.50		285.00	127.50	63.75
Woodbury,	27.00	40.00	12.00	2.50	69.00	31.00	5.00	161.00	7.00	6.00	3.00		545.00	405.00	202.50
Housatonic, New Milford,	20.00	39.00	20.00	8.00	200.00	18.00	16.00	81.00	45.00	2.00	3.50	12.00	664.00	451.50	448.50
Watertown,	44.00	†116.00			59.00	36.00	11.00	58.00	11.00	13.00	17.00	175.00			540.25
Danbury,	45.50	57.00	24.50	1.50	118.00	35.00	21.00	149.00	49.00	22.00	27.00	28.00	675.00	577.50	566.00
Ridgefield,	32.00	17.00	21.00	5.00	134.00	27.00	12.00	266.00	28.00	36.00	19.50	65.00	792.00	662.50	647.50
Tolland Co., East,	16.00	15.00	35.00	7.00	8.00	7.00		73.00	2.00	3.00	9.90	74.00		249.90	249.90
Milford and Orange,	5.50	21.00	3.50		68.00	12.00	8.00	56.00	12.50	16.00	16.50		419.00	235.50	
Oxford,	1.00	3.00	11.50		34.50	8.50	5.00	38.00	3.00		.50		139.00	95.00	95.00
Bethany,	12.00	7.00			12.00	2.00	13.00	24.50	2.50		11.25		84.25		

* No Fairs. † Heifers and Calves.

ANALYSIS OF PREMIUMS AND GRATUITIES.—CONTINUED.

FARM PRODUCTS.

SOCIETIES.	Indian Corn.	Wheat.	Rye.	Oats.	Beans.	Grass Seed.	Potatoes.	Carrots.	Beets.	Parsnips.	Turnips.	Onions.	Other Root Crops & Vegetables.
*Hartford,													
*New Haven,													
New London,	$ 4.75		$1.00	$1.50	$3.50		$ 5.50	$ .50		$1.00	$1.50	$2.50	$15.50
Fairfield,	10.00	$4.00	3.00	3.00	2.00	$8.00	24.50	1.50	$1.50	1.50	1.50	8.50	19.00
Windham,	5.25		1.50	1.50	2.25		9.50	.50	2.00	.50	1.00	2.00	
Litchfield,													
Middlesex,	1.50	1.25	1.25	.75	1.50	.75	10.50	3.50	1.50	.50	1.25	1.00	
Tolland,	1.50		3.50	2.50	.50		6.00	.50	.50		.50	.50	
Pequabuck,	1.00			.50	.50		5.25		.25			.25	
Woodbury,	1.75	.50	.75	.50	.50		2.50	.75	.75	.75	.75	.25	3.00
Housatonic, New Milford,	3.00		1.50	1.00	.75		3.00		1.75	.50	2.00	2.00	3.00
Watertown,													
Danbury,	4.00	2.50	2.50	7.50	1.50	4.00	12.75	.75	.75		.75	4.00	36.00
Ridgefield,	11.00	12.00	9.50	6.00	1.50	5.00	19.00	.75	.75	.25	1.25	6.50	13.70
Tolland County East,	2.00	.50		.50	1.25		11.75	.50	.75	.50	1.25	1.25	2.00
Milford & Orange,	6.00	1.50	1.50	1.50	.50		13.25	1.25	4.75	1.50	3.00	1.50	13.50
Oxford,	4.75	1.00	1.00	.50	1.00		5.00	1.00	.50	.50	.75	.50	
Bethany,	3.00	.50	.75	.75	4.25		4.75	.50	1.50		1.00	1.25	

*No Fair.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.—CONTINUED.

FARM PRODUCTS.

SOCIETIES.	Total Amount offered for Grain & Root Crops.	Total amount awarded for Grain & Root Crops.	Total Amount paid for Grain & Root Crops.	Plowing at Exhibition.	Fruits.	Flowers.	Butter.	Cheese.	Honey, Maple Sugar, & Preserved Fruits.	Bread & Cake.	Total Amount paid out under the head of Farm Products.	Amount awarded for Farm Implements, &c.	For Mechanical Inventions, Domestic Manufactures, &c.	No. of persons who received Premiums & Gratuities.	No. of Diplomas.
*Hartford, - - - - -															
*New Haven, - - - -															
New London, - - - -	$ 60.00	$33.75	$30.38		$37.00	$ 6.00	$15.00	$11.00	$ 3.00	$ 7.50	$113.25	$10.00	$63.00	173	20
Fairfield, - - - - -	127.50	88.00			126.50	72.00	8.00	5.00	21.00	12.00	367.50	15.00	93.00		16
Windham, - - - - -	55.00	27.00	27.00	$25.00	67.75	26.50	19.00	14.00	12.50	9.00	191.50	16.75	93.00	185	
Litchfield, - - - - -	49.00	38.00	38.00		25.00	10.00	7.00	7.00	3.00	5.00	133.00	10.00	177.00		
Middlesex, - - - - -	85.00	54.00	50.00		29.75	13.25	7.75	4.50	2.50	5.00	83.00	13.00	42.00	125	
Tolland, - - - - -				13.00	50.25	2.00	3.50	4.00	4.50	3.00	98.25	2.00	50.00	150	
Pequabuck, - - - - -					10.25	2.00	1.50	1.50	1.25	1.25			17.00	67	
Woodbury, - - - -	22.50	16.75	8.37		10.50	7.75	1.75	1.50	1.50	1.50	20.62	1.00	13.50	108	
Housatonic, New Milford, -	23.50	22.75	18.75		8.75	6.75	3.00	3.00	3.40	4.50	47.50	16.25	69.45	169	
Watertown, - - - -						6.50	1.00	2.00	2.00	1.00		20.00	20.00	125	
Danbury, - - - - -	93.75	77.00	76.50		47.50	30.00	3.50	3.00	5.00	15.00	180.50	13.50	170.25	291	
Ridgefield, - - - -	131.00	89.70	88.20		35.00	47.25	1.50	1.50	13.00	18.00		10.00	106.00	225	6
Tolland County East, - -		22.75	22.75		11.00	2.25	1.50	2.50	3.75	2.50		10.00	18.00		
Milford & Orange, - -	75.00	50.00			31.25	5.00	3.00	3.00	5.00	4.00	101.00	8.00	26.00	134	4
Oxford, - - - - -	15.75	22.00	22.00		9.00	5.00	3.00	2.00	2.50	3.50	55.00		21.25	164	
Bethany, - - - - -					19.50	5.25	3.00	1.00	.75	1.50	49.75				

No Fair.

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